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NATURAL
HISTORY.

ANNUAL REPORT

OF THE COUNCIL

OF THE

YORKSHIRE PHILOSOPHICAL SOCIETY

FOR THE YEAR

1932

PRESENTED TO THE ANNUAL MEETING,

FEBRUARY 13th, 1933.

PRINTED BY ORDER OF THE COUNCIL.

1933.

Issued April 10th, 1933.

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BRITISH MUSEUM
NATURAL HISTORY

FORM
OF A
BEQUEST TO THE SOCIETY.

Every person desirous of bequeathing to the Society any sum of Money, Specimens, Books, Instruments, or other Property, is requested to make use of the following form:—

I give and bequeath to the Trustees, for the time being, of the Society established at York, called "**The Yorkshire Philosophical Society,**" *for the use of the said Society, the sum of* *to be paid out of such part of my personal estate as I may legally charge therewith.* [Or here enumerate the effects or property intended to be bequeathed.] *And I direct that the receipt of the Treasurer of the said Society, for the time being, shall be an effectual discharge to my Executors for the said legacy.*

The Yorkshire Philosophical Society.

(Founded 1822.)

Patrons :

HIS MAJESTY THE KING. HER MAJESTY THE QUEEN.

Trustees :

GEORGE A. AUDEN, M.D.
CHAS. E. ELMHIRST, J.P.
RT. HON. LORD DERAMORE.

President :

William Herbert St. Quintin, D.L., J.P., F.Z.S.

Vice-Presidents :

W. A. Evelyn, M.A., M.D.
Chas. E. Elmhirst, J.P.
W. Harvey Brook.
Col. W. A. White, J.P.
Sydney H. Smith, F.Z.S.
J. Triffitt.
H. M. Platnauer, B.Sc.
Ald. W. H. Birch, J.P.
S. Walker, F.E.S.
H. J. Wilkinson.
Arthur Hurst, A.K.C.
Richard Thompson.

Council :

Elected 1931...J. L. Brockbank, M.A., H.M.I.
John A. Cooper.
Sidney Melmore, B.Sc., F.G.S.
A. W. Ping, M.A.

Elected 1932...E. Baker.
J. H. Collinson, M.A.
G. W. Daniel.
Rev. A. Raine, M.A.

Elected 1933...R. H. Chapman.
M. du Bois Ferguson, M.D., D.P.H.
Frank W. Terry.
Geoffrey Thompson, M.A.

Hon. Treasurer :

S. Walker, F.E.S.

Hon. Secretary :

Chas. E. Elmhirst, J.P.

Committees :

General Purposes and Finance Committee :

J. L. Brockbank.
W. Harvey Brook.
John A. Cooper.
Dr. W. A. Evelyn.
Arthur Hurst.
Sidney Melmore.
Rev. A. Raine.
Frank W. Terry.
J. Triffitt.
S. Walker.

Chas. E. Elmhirst, *Secretary.*

Garden Committee :

E. Baker.
R. H. Chapman.
J. H. Collinson.
G. W. Daniel.
Arthur Hurst.
Sidney Melmore.
A. W. Ping.
Col. W. A. White.

S. Walker, *Secretary.*

Museum Committee :

W. Harvey Brook.
Dr. W. A. Evelyn.
Arthur Hurst.
Sidney Melmore.
Rev. A. Raine.
J. Scott.
Sydney H. Smith.
H. Sowden.
Geoffrey Thompson.
S. Walker.
H. J. Wilkinson.
Dr. Collinge, *Secretary.*

Abbey Restoration Committee :

Ald. W. H. Birch.
John A. Cooper.
Chas. E. Elmhirst.
Rev. A. Raine.
Sydney H. Smith.
Frank W. Terry.
J. Triffitt.
S. Walker.
H. J. Wilkinson.
Dr. Collinge, *Secretary.*

Building Sub-Committee :

ALD. W. H. BIRCH.
J. TRIFFITT.
CHAS. E. ELMHIRST.
S. WALKER.
DR. COLLINGE, *Secretary*.

The President, Hon. Secretary, Hon. Treasurer and Keeper are *ex-officio* members of all Committees.

York and District Field Naturalists' Section.

President :
HENRY J. WILKINSON.

Vice-Presidents :
A. J. A. WOODCOCK, M.SC.
C. R. FEATHERSTONE, M.A.
V. G. F. ZIMMERMANN.
F. VEAR.

Hon. Treasurer : G. MACHIN,
42, Vyner Street, York.

Hon. Secretaries : A. W. PING, M.A., K. G. CHILMAN,
St. Peter's School, Clifton, York.

REPORT OF THE COUNCIL
OF THE
YORKSHIRE PHILOSOPHICAL SOCIETY.
13th FEBRUARY, 1933.

THE important event of the past year has been the visit of the British Association to York on the occasion of its one-hundred and first meeting (August 31st to September 7th). The number of members attending the meeting was 2,024. Section D.—Zoology—held its meetings in the Tempest Anderson Hall, under the Presidency of the Rt. Hon. Lord Rothschild.

The Museum, Ruins, and Gardens were daily visited by large numbers of the Members.

From August 31st to September 10th, the Gardens and Ruins were flood-lighted each evening, and in spite of the bad weather upwards of ten thousand people witnessed the demonstrations. The Museum was thrown open from 7 p.m. to 10-30 p.m., and attracted large numbers of visitors.

To commemorate the restoration and re-opening of the Hospitium a bronze enamelled plaque has been placed on the west wall of the extension.

The following is a full list of the Lectures delivered in the Tempest Anderson Hall during the past year :—

Thursday, January 7th.—" The Saint William Window—York Minster." By The Rev. F. Harrison, M.A., F.S.A.

Thursday, January 21st.—" Some Atmospheric Phenomena." By A. W. Ping, M.A., F.R.Met.Soc.

Thursday, February 4th.—" Observations on some British Birds." By Chas. E. Elmhirst, J.P.

Thursday, February 18th.—" Some further contents of the Hospitium." By The Rev. A. Raine, M.A.

Thursday, October 13th.—" Scarborough in the Middle Ages." By Arthur Rowntree, M.A.

Thursday, October 27th.—" The Drama of to-day." By Beatrice Forbes-Robertson. (Mrs. Forbes-Robertson Hale.)

Thursday, November 10th.—" Plants, small and great." By Prof. F. O. Bower, Sc.D., LL.D., F.R.S.

Thursday, November 24th.—" With the North West Mounted Police." By Capt. H. G. Mansfield, M.C.

Thursday, December 8th.—" Tree Magic." By Capt. R. St. Barbe Baker.

Your Council would much like to see an increase in the number of members. For a very small annual subscription the Society has much to offer its members, and with the active support of an increased number much more might be accomplished both scientifically and educationally.

The number of Saturday afternoon visitors to the Gardens and Museums has exceeded any figure previously recorded.

Your Council regret to have to record the decease of the Very Reverend the Dean of York (Dr. Lionel Ford) and Mr. T. G. Swale, who was a member of the Council from 1924 to 1926; also an Honorary Member, Professor G. Baldwin Brown, M.A., LL.D., F.S.A. (who for many years past took a great interest in our museum), who died at Edinburgh on July 12th, aged 82. For a period of fifty years he occupied the chair of Fine Art in the University of Edinburgh, a period equalled on only two occasions in the history of the University.

FIELD NATURALISTS' SECTION. Once again it is pleasing to record that the Section has maintained satisfactory progress, and useful Field work has been done.

At the Annual Meeting it was decided to form an additional section for the special study of Fresh-water Biology in our area. Mr. C. Allen was appointed the Sectional Recorder, and his first Report gives an excellent classified record of the area covered, illustrated by detailed photographs.

Early in the year it was agreed that members of the Field Naturalists' Section should endeavour to arrange an Exhibition illustrative of local natural history, to be shown during the occasion of the visit of the British Association to York. The use of three rooms in the Technical Institute, Clifford Street, was kindly granted by the City authorities, and an extremely interesting series of exhibits was shown by the following members.

Mr. Charles Allen prepared no less than 125 aquarium tanks, each containing species of local freshwater life. These tanks were arranged in scientific order, and by skilful arrangement of electric lighting showed the living specimens to great advantage. The exhibits ranged from the larger fishes, freshwater mollusca, plant life, water beetles, to the smaller crustacea.

Mr. F. Vear had on view a large number of lantern slides illustrating local birds, particularly of the Black-headed Gull at Skipwith Common. Mr. H. Sowden also had a most instructive set of lantern slides, many of them showing stages of development in insect life. The exhibits of local Lepidoptera were from the collections of Mr. A. Smith and Mr. H. Dobson. Conchology was represented by collections of land and fresh-water shells shown by Mr. H. Dobson, Mr. A. Smith, and Mr. H. Sowden. Mr. G. Machin showed freshly gathered and pressed specimens of every one of the twenty-one species of fern to be found in our district, and Miss S. Jackson gathered fresh specimens of a number of interesting and uncommon plants from Strensall.

The Exhibition was open during each day from September 1st—7th, and was visited by a large number of people.

At the close of the year Membership of the Section, including Honorary and Corresponding Members, stands at 124, a net increase of four on the previous year.

The Lectures and Excursions during 1932 have been as follows :—

January 13th.—Entomological Recorder's Report. A. Smith. Paper : "The Tansy Beetle." A. J. A. Woodcock, M.Sc.
January 27th.—Lantern Lecture : "The Living Plant." C. R. Featherstone, M.A.
February 10th.—Four Lecturettes.
February 24th.—Botanical Recorder's Report. J. H. Evers. "Botany notes and observations." Rev. G. H. Chilman, M.A.
March 9th.—Lantern Lecture : "The Life and Habits of the Honey Bee." R. L. Ball.
March 23rd.—Recorders' Reports : Ornithology, V. G. F. Zimmermann. Vertebrate Zoology, S. H. Smith, F.Z.S.
April 6th.—Annual Meeting.
May 28th.—Excursion to Burton Fields Gravel Pits, near Stamford Bridge.
June 8th.—An Evening Ramble near Buttercrambe.
June 11th.—Excursion to Strensall. (Jointly with the Yorkshire Conchological Society.)
June 22nd.—A Visit to East Moor, near Sutton-on-Forest.
July 6th.—A Visit to the Hermitage, Malton Road.
July 20th.—An Excursion to Gilling.
July 30th.—An Excursion to Kirby Underdale.
August 20th.—An Evening Ramble on Clifton Ings.
Sept. 1st-7th.—Natural History Exhibition.
September 28th.—Excursion and Fungus Foray to Sand Hutton Woods : also an evening meeting to inspect and discuss the specimens gathered.
October 5th.—Lantern Lecture : "Some Notes on British Reptiles." E. W. Taylor.
October 19th.—General Exhibit Night.
October 28th.—Excursion and Fungus Foray to the Hermitage.
November 2nd.—Geological Recorder's Report. Lantern Lecture : "Peat." J. A. Dell, M.Sc.
November 16th.—Recorder's Report on Fresh-water Biology. Lantern Slides and Notes. C. Allen.
November 30th.—Lantern Lecture : "Studying the Sky with a Camera." J. Scott.
December 14th.—Conchological Recorder's Report. Paper and Lantern Slides : "Shell Lore." H. Sowden.

NEW MEMBERS, ELECTED IN 1932.

Barton, A., 28 Marygate.
Bate, The Very Rev. H. N., Dean of York, The Deanery.
Bean, G. R., The Probate Registry, Duncombe Place.
Beckwith, W. H., 15 Queen Anne's Road.
Bloomer, A. C., 6 The Avenue, Clifton.
Braithwaite, Miss M. E., 17 Longfield Terrace.
Chapman, A. E., M.A., LL.D., 7 New Walk Terrace.
Dodd, E. R., A.S.A.A., " West House," South Mount Terrace.
Drake, G. R., Market Place, Easingwold.
Duncanson, Miss F. E., 12 Minster Yard.
Dunsford, Mrs. A. M., 15 Longfield Terrace.
Knowles, J. A., F.S.A., 23 Stonegate.
Laughton, F. W., 104 Heworth Green.
Lee, B. E., 10 Church Street.
Marshall, W., M.B.E., A.M.Inst.T., Foss Islands Coal Depot.
Rymer, H. V., 12 Huntington Road.
Walker, W., " Albany House," Scarcroft Road.
Warner, I., 9 St. Peter's Grove.
Windley, The Rev. F. M., M.A., St. Olave's Vicarage, 52 Bootham.
Wood, L. F., 2 The Sycamores, Sycamore Place.
York, His Grace the Archbishop of (The Most Rev. William Temple M.A., D.Litt.), Bishopthorpe.

DEATHS.

HONORARY MEMBER.

Brown, Prof. G. Baldwin, M.A., LL.D., F.S.A.

MEMBERS.

Dunsford, G. E., 15 Longfield Terrace.
Ford, The Very Rev. Dr. Lionel, Dean of York.
Guy, The Rev. Canon T. E. B., M.A., 3 Bootham Grange.
Hall, J. R. Clark, 15 Ashburnham Gardens, Eastbourne.
Harrison, Mrs. E., 13 Portland Street.
Milner, Thos., 11 Avenue Terrace, Clifton.
Swale, T. G., 12 Queen Anne's Road.

ASSOCIATE.

Davis, J. W., " Cintra," Carr Lane, Acomb.

RESIGNATIONS.

Members, 22. Lady Subscribers, 2.

DEATH AND RESIGNATION.

Members	29
Lady Subscribers	2
Associates	1
	32

NEW MEMBERS.

21

TOTAL MEMBERSHIP ON 31st DECEMBER, 1932.

Honorary Members	30
Members	364
Lady Subscribers	42
Associates	9
	445

LIST OF HONORARY MEMBERS.

1. 1927. Bather, F. A., M.A., D.Sc., F.R.S., F.G.S., 46 Marryat Road, London, S.W. 19.
2. 1926. Benson, George, A.R.I.B.A., Thirsk Road, Easingwold.
3. 1897. Berget, Baron A., Sorbonne, Paris.
4. 1888. Bobretzki, Dr., The University, Kiev.
5. 1906. Bower, F. O., M.A., Sc.D., LL.D., F.R.S., The Crescent, Ripon.
6. 1898. Clark, J. E., B.A., B.Sc., 41 Downscourt Road, Purley, Surrey.
7. 1923. Clarke, Wm. Eagle, I.S.O., LL.D., F.R.S.E., The Royal Scottish Museum, Edinburgh.
8. 1924. Collingwood, R. G., M.A., F.S.A., Haverfield Library, Ashmolean Museum, Oxford.
9. 1906. Cornish, Vaughan, D.Sc., Inglewood, Camberley, Surrey.
10. 1898. Crichton-Browne, Sir James, M.D., LL.D., D.Sc., F.R.S., 45 Hans Place, London, S.W. 1.
11. 1926. Fox, Cyril, Ph.D., F.S.A., Director of the National Museum of Wales, Cardiff.
12. 1920. Grabham, Oxley, M.A., Heron Cottage, Thornton Dale, Yorks.
13. 1923. Harmer, Sir Sidney F., K.B.E., Sc.D., F.R.S., The Old Manor House, Melbourn, near Royston, Herts.
14. 1924. Kendall, Prof. Percy F., D.Sc., F.R.S., F.G.S., Briarwood, Frinton-on-Sea, Essex.
15. 1926. Keith, Sir Arthur, M.D., LL.D., F.R.C.S., F.R.S., Conservator of Museum and Hunterian Professor, Royal College of Surgeons of England, London, W.C.
16. —— Lightfoot, Thomas, Masham, Yorks.
17. 1929. Maclagan, Sir Eric, C.B.E., M.A., F.S.A., Director and Secretary of the Victoria and Albert Museum, London, S.W. 1.
18. 1901. Macnamara, W. H., Railway Commission, Courts of Justice, London.
19. 1925. Marriott, Sir John A. R., M.A., 17 Belgrave Square, London.
20. 1906. Müller, Sophus, Prindsens Palais, Copenhagen.
21. 1926. Peers, Sir C. R., C.B.E., M.A., F.B.A., F.S.A., Chief Inspector of Ancient Monuments, H.M. Office of Works, London.
22. 1927. Regan, C. Tate, M.A., D.Sc., F.R.S., F.L.S., Director of the British Museum (Nat. Hist.), London, S.W.
23. —— Sadler, Sir Michael Ernest, K.C.S.I., C.B., D.Litt., LL.D., Master of University College, Oxford.
24. 1906. Shetelig, Dr. Haakon, Bergens Museum, Bergen, Norway
25. 1924. Smith, Arthur H., M.A., F.S.A., 2 Balfour Road, Weybridge, Surrey.
26. 1929. Thompson, Professor A. Hamilton, M.A., D.Litt., F.S.A., The University, Leeds.
27. 1930. Wheeler, R. Mortimer, M.C., D.Litt., M.A., F.S.A., London Museum, Lancaster House, London, S.W.
28. 1926. Woods, Henry, M.A., F.R.S., Sedgwick Museum, Cambridge.
29. 1923. Woodward, Sir A. Smith, LL.D., F.R.S., F.G.S., Hill Place, Hayward's Heath, Sussex.
30. 1922. Yeld, George, M.A., Orleton, Gerrard's Cross, Bucks.

PAST PRESIDENTS
OF THE
YORKSHIRE PHILOSOPHICAL SOCIETY.

1822-1830.	The Rev. William Venables Vernon, F.R.S., F.G.S. (Resigned at Annual Meeting, February, 1831.)
1831-1857.	The Viscount Milton, F.R.S., F.S.A. (afterwards became the Earl Fitzwilliam). (See Ann. Rpt. for 1857, p. 15.) (Died 1857.)
1858-1864.	The Earl of Carlisle, K.G., F.R.S. (Died 1864.)
1865-1890.	His Grace the Lord Archbishop of York. (William Thomson, F.R.S., F.G.S.) (See Ann. Rpt. for 1890, p. 14.) (Died 1890.)
1892-1906.	Sir Charles Strickland, Bart., F.G.S. (Resigned early in 1906.)
1906-1913.	Tempest Anderson, M.D., D.Sc. (Died 26th August, 1913.)
1914-1933.	William Herbert St. Quintin, D.L., J.P. (Died January 21st, 1933.)

THE TREASURER'S ACCOUNT IN CONNECTION WITH THE FUND FOUNDED BY THE LATE WM. REED, ESQ., FOR SPECIFIC PURPOSES, 1932.

Dr. INCOME.	£	s.	d.	EXPENDITURE.	£	s.	d. Cr.
To Balance brought forward	13	19	0	By New Books	8	18	6
,, Interest on York Corporation 3% Redeemable Stock, less tax	13	5	6	Excess of Income over Expenditure	24	13	0
,, Interest on £50 placed on Deposit with Midland Bank, Ltd.	1	5	0				
,, Income Tax recovered, 1932	4	19	0				
,, Bank Interest	0	3	0				
	£33	11	6		£33	11	6

BALANCE SHEET.

	£	s.	d.		£	s.	d.
Amount of Fund on 31st December, 1932 ...	674	13	0	Amount invested in York Corporation 3% Redeemable Stock	600	0	0
				Amount placed on Deposit with the Midland Bank, Ltd.	50	0	0
				Balance at Midland Bank, Ltd.	24	13	0
	£674	13	0		£674	13	0

Audited and found correct.

SAMUEL WALKER,
Hon. Treasurer.

ARTHUR D. GLADWIN,
February 9th, 1933.

Dr. ST. MARY'S ABBEY RESTORATION FUND, 1932. Cr.

INCOME.	£	s.	d.	EXPENDITURE.	£	s.	d.
To Subscriptions for 1932	11	6	6	By Balance brought forward	640	19	8
,, Y.P.S. General A/c. (Exhibition Land) ...	475	0	0	,, G. Walker & Son (Repair of Hospitium) ...	222	6	1
,, Amount transferred from Fabric Fund ...	46	1	0	,, Supervisor's Fees	7	0	0
,, Balance	353	19	3	,, Bank Interest and Commission	16	1	0
	£886	6	9		£886	6	9

STATEMENT OF FUND.

	£	s.	d.		£	s.	d.
To Subscriptions received to 31st Dec., 1932 ...	419	2	6	By G. Walker & Son (Repair of Hospitium) ...	4772	6	1
,, Champney Bequest	2141	15	7	,, York Corporation (Electric Heating) ...	265	18	0
,, Y.P.S. General A/c.	1944	12	0	,, Supervisor's Fees	40	10	0
,, Fabric Fund	297	6	3	,, General Expenses	48	14	10
,, War Stock Interest	12	7	0	,, Bank Interest and Commission	44	18	0
,, Profit on Sale of War Stock	3	4	4				
,, Amount due to Midland Bank, Ltd. ...	353	19	3				
	£5172	6	11		£5172	6	11

Audited and found correct.

SAMUEL WALKER,
Hon. Treasurer.

ARTHUR D. GLADWIN,
February 9th, 1933.

MILLION SHILLING FUND, 1932.

Dr. INCOME.	£	s.	d.	Cr. EXPENDITURE.	£	s.	d.
To Balance brought forward	32	14	8	By Balance	37	2	8
,, Subscriptions for 1932	4	0	0				
,, Bank Interest		8	0				
	£37	2	8		£37	2	8

BALANCE SHEET.

	£	s.	d.		£	s.	d.
Amount of Fund, 31st December, 1932	37	2	8	Balance at Midland Bank, Ltd.	37	2	8
	£37	2	8		£37	2	8

STATEMENT OF FUND.

	£	s.	d.		£	s.	d.
To Subscriptions received to 31st December, 1932	955	13	8	By New Cases	880	8	0
,, War Stock Interest	109	9	2	,, General Expenses (Printing and Stationery, etc.)	165	17	6
,, Bank Interest, less Commission	17	19	0	,, Balance at Midland Bank, Ltd.	37	2	8
,, Profit on Sale of War Stock	0	6	4				
	£1083	8	2		£1083	8	2

Audited and found correct.

SAMUEL WALKER,
Hon. Treasurer.

ARTHUR D. GLADWIN,
February 9th, 1933.

Dr. FABRIC FUND, 1932. **Cr.**

INCOME.	£	s.	d.	EXPENDITURE.	£	s.	d.
To Balance brought forward	1	6	2	By St. Mary's Abbey Restoration Fund ...	46	1	0
,, $\frac{1}{7}$th Income Tax recovered, 1932	46	1	0	,, Balance	1	6	2
	£47	7	2		£47	7	2

BALANCE SHEET.

	£	s.	d.		£	s.	d.
Amount of Fund, 31st December, 1932 ...	1	6	2	Balance at Midland Bank, Ltd.	1	6	2
	£1	6	2		£1	6	2

STATEMENT OF FUND.

	£	s.	d.		£	s.	d.
To $\frac{1}{7}$th Income Tax recovered	283	1	8	By St. Mary's Abbey Restoration Fund ...	297	6	3
,, War Stock Interest	11	0	6	,, Balance at Midland Bank, Ltd.	1	6	2
,, Bank Interest, less Commission	2	5	0				
,, Profit on Sale of War Stock	2	5	3				
	£298	12	5		£298	12	5

Audited and found correct.

SAMUEL WALKER,
Hon. Treasurer.

ARTHUR D. GLADWIN,
February 9th, 1933.

THE TREASURER IN ACCOUNT WITH THE YORKSHIRE

INCOME.

Last Year		£	s.	d.	£	s.	d.
	Subscriptions :						
	Members	688	2	0			
	County Members	2	1	0			
	Lady Subscribers	41	0	0			
	Associates	9	0	0			
	Ticket Holders (less Refunds)	10	0	0			
	Arrears	12	0	0			
	Subscriptions for 1933 paid in advance	19	0	0			
	Keys of Gates	82	12	6			
887					863	15	6
	Rents :						
	St. Mary's Lodge	65	0	0			
	Shop, No. 10 Bootham	25	0	0			
	York Waterworks Co.—Shed	15	0	0			
	Do. Light	0	1	0			
	Mr. Hill—Notice Board	0	1	0			
	Corporation of York, Lease of Exhibition Land	1	1	4			
	Post Office—Wayleaves	1	2	0			
	York Diocesan Training College—Boat Yard	5	0	0			
	Baths Cottage, Marygate	24	11	0			
105	Letting of Rooms for Lectures and Meetings	66	4	0			
301					203	0	4
1988	The late Dr. Anderson's Bequest				1909	15	4
27	Interest on £918 8s. 9d. India 3 % Stock (the late Mr. Rawdon's Bequest)				27	11	0
	Interest on £80 Deposit at Midland Bank				1	15	10
	Sale of Exhibition Land				1000	0	0
436	Gate Money				461	18	4
30	Whitsuntide Admission Fees, less expenses				19	16	7
	Flood-lighting ,, ,, ,, ,,				33	2	11
60	Sale of Picture Postcards, Plans, Reports, etc.				66	9	5
	,, ,, Old Material and Discount				1	15	10
20	Bowling Green Members' Subscriptions				23	17	0
	,, ,, Locker Rents				2	2	0
	Donation for holding of Pilgrimage				5	0	0
	Meteorological Grant for 1932				5	0	0
	Bank Interest, less Commission				0	16	0
					£4625	16	1
	Excess of Expenditure over Income				211	8	9
					£4837	4	10

	£	s.	d.
Balance due to Treasurer, 31st December, 1931	2	16	1
Excess of Expenditure over Income, 1932	211	8	9
	£214	4	10

I have compared the statements herewith submitted with the Books, Accounts and Vouchers relating thereto, and certify them to be correct. I have verified the existence of the Cash Balances and investments.

February 9th, 1933. ARTHUR D. GLADWIN.

PHILOSOPHICAL SOCIETY FOR THE YEAR ENDING 31ST DEC., 1932.

EXPENDITURE.

Last Year			£ s. d.	£ s. d.
	Rent, Rates and Taxes :			
	Corporation Rent		20 0 0	
	Property Tax and City Rates		70 1 11	
	Waterworks Company's Rates		9 4 11	
	Gardeners' Licence		3 0 0	
101				102 6 10
	Insurance :			
	Fire Premiums, etc.		19 14 6	
	Boiler Insurance		8 3 0	
	Employers' Liability Premium		6 9 5	
	Fidelity Guarantee Premium		1 10 0	
	National Health and Unemployment Insurance		32 4 7	
65				68 1 6
13	Telephone Rent and Calls			14 6 0
	Salaries and Wages :			
	Museums		1901 12 9	
	Lodge and Gardens		676 4 1	
	Staff Pensions		121 17 6	
2670				2699 14 4
	General Additions, Repairs, etc. :			
	MUSEUMS—			
	Additions	41 17 0		
	Repairs	15 9 5		
	General Expenses	90 0 3		
143			147 6 8	
	GARDENS—			
	General Expenses	83 9 4		
	Bowling Green	11 1 6		
90			94 10 10	
	ESTATE—			
	Hospitium	100 0 0		
	General Repairs, etc.	100 3 11		
192			200 3 11	
425				442 1 5
	Coal, Coke, Gas, and Electricity :			
101	Coal and Coke		110 14 4	
11	Gas		10 18 0	
44	Electricity		103 10 5	
156				225 2 9
48	Library—Books and Binding			59 9 6
45	Lectures			35 0 0
	Printing and Stationery :			
46	Annual Reports and Proceedings		34 8 0	
20	General Printing and Stationery		33 18 2	
66				68 6 2
	Guides to Museums and Gardens			31 0 0
	Commissioners of Crown Lands			525 0 0
	Abbey Restoration Fund			475 0 0
	Fabric Fund			46 1 0
18	Picture Postcards			29 3 4
16	Postages and Receipts			15 0 0
	Cheque Book			1 12 0
				£4837 4 10
	Balance due to Treasurer, 31st December, 1932		214 4 10	
			£214 4 10	

SAMUEL WALKER,
Hon. Treasurer.

THE LATE DR. ANDERSON'S BEQUEST.

	£	s.	d.
Interest on £8,000 New Zealand 4% Inscribed Stock	320	0	0
„ on £5,700 London & North Eastern Railway 4 % First Preference Stock	82	13	0
„ on £2,500 London & North Eastern Railway 4 % Second Guaranteed Stock	73	15	0
„ on £8,000 Canada 4% Registered Stock...	236	0	0
„ on £3,219 3s. 5d. Bank of England Stock	289	14	6
„ on £5,777 2s. 6d. South Indian Railway 4% Registered Debenture Stock	170	8	6
„ on £4,314 13s. 2d. 5% War Loan Stock (now 3½% Conversion Loan)	215	14	6
Bonus on the Conversion Loan	43	2	11
„ on £2,000 4½% Conversion Loan	90	0	0
„ on £45 Deposit at Midland Bank	1	0	2
Rents of Shops and Dwelling-houses, Nos. 32 & 34, Bootham	65	0	0
Income Tax recovered (1 year)	322	6	9
	£1909	15	4

Memo. :—The above items are shown less tax, if deducted.

BRITISH MUSEUM
19 APR 33
NATURAL HISTORY

The Yorkshire Museum,

YORK.

Report

of the

Museum Committee

FOR THE YEAR 1932.

PRINTED BY ORDER OF THE COUNCIL.
1933.

THE YORKSHIRE MUSEUM,

YORK.

Keeper :

WALTER E. COLLINGE, D.SC., M.SC., F.S.A., F.L.S.,
M.B.O.U., HON. F.R.H.S.

Honorary Curators :

ARCHÆOLOGY - - -	W. HARVEY BROOK. W. A. EVELYN, M.A., M.D. (Cantab.)
GEOLOGY - - - -	SIDNEY MELMORE, B.SC., F.G.S.
ROMAN ANTIQUITIES -	REV. A. RAINE, M.A.
BOTANY - - - - -	H. J. WILKINSON.
ZOOLOGY - - - -	SYDNEY H. SMITH, F.Z.S.
ENTOMOLOGY - - -	S. WALKER, F.E.S.
CONCHOLOGY - - -	H. SOWDEN.
ASTRONOMY - - -	J. SCOTT.
NUMISMATICS - - -	GEOFFREY THOMPSON, M.A.
CERAMICS - - - -	ARTHUR HURST, A.K.C.

Sub-Curator : W. WATSON.

Assistants :
MISS E. HOLMES.
FRANCIS T. G. WHITE.
MISS W. BRITTON.

Chief Clerk : ARTHUR COLLEY.

Museum Attendants :
WILLIAM RAFTON and MISS G. FISHER.

THE YORKSHIRE MUSEUM.

REPORT FOR THE YEAR 1932.

THE work of re-arrangement and classification of the specimens in the Museum of Roman Antiquities and the Geological Collections has been continued.

During the latter half of the year two very important loan collections have been on view, viz.: The Hurst Collection of York Silver Plate, and a collection of palæolithic specimens from the upper part of Nidderdale, loaned by Major E. R. Collins. Both have attracted considerable attention.

The Yorkshire Architectural and York Archæological Society continues to hold its meetings and house its Library in the Museum.

The September meeting of the Yorkshire Numismatic Society was held in the Museum on the 17th, when numerous exhibits were shown from the Museum's collections.

Several alterations have been made in the work room which have enabled the Keeper to provide more adequate space for the Herbarium. This historic and fine collection, which has been under the care of Mr. H. J. Wilkinson for upwards of forty years, is all too little known. The time and work expended upon it by Mr. Wilkinson are well known, and the thanks of the Council have frequently been accorded to him. At considerable personal expense Mr. Wilkinson has prepared charts of each plant, showing its range, Highland or Lowland, and census of distribution in the British Isles. During the year Mr. Wilkinson has presented a further cabinet for the Herbarium and upwards of 2,000 specimens of British Flowering Plants.

EDUCATIONAL WORK. During the year, 978 children from Schools in the City attended the Museum for study and instruction, and 164 students from the City School of Arts and Crafts.

In response to a circular letter to the various educational authorities in Yorkshire there has been a gratifying increase in the number of schools visiting the Museums. These visits have been of an educational character, and numerous letters from both teachers and scholars testify to the interest they have aroused and the benefits obtained.

Numerous schools and other organizations have visited the Museum during the past year. (For full list see p. 31.)

SPECIAL EXHIBITS. Amongst these have been the Mediaeval Purses, and the Collection of Monastic Lamps.

The Collections or specimens have been studied by T. D. Cowen, Shotley Bridge ; G. H. Richardson, Newcastle-on-Tyne ; Dr. Willoughby Gardner, F.S.A., Deganwy ; James A. Wright, Kirkcaldy ; J. A. Stanfield, London ; Wilfred N. Edwards, B.A., British Museum (Nat. Hist.), London ; Dr. F. Corner, London ; Dr. Errol I. White, British Museum (Nat. Hist.), London ; C. J. R. Husband, Ripon ; Mr. and Mrs. Sutherland-Graeme, London ; G. C. F. Hayter, B.A., F.S.A., London ; Miss Françoise Henry, Musée Antiquités Nationales, St. Germain-en-Laye ; Dr. W. J. Arkell, M.A., University Museum, Oxford ; and S. N. Miller, M.A., The University of Glasgow.

Turning to the different departments of the Museum :—

ETHNOLOGY. The whole of the Collections in this gallery have been cleaned and to a slight extent re-arranged. A number of small objects have been added to the " Bygones " and to the Collection of Pewter. The Society is indebted to Mr. and Mrs. Geoffrey Thompson for a very fine Pewter Tankard made by Edmond Harvey, of York (1714-1720), and to Mr. J. C. Fenton for a Pewter christening (?) Bowl. A new wall case has been added to contain the Rougier Collection of Combs and Comb-making Tools, illustrating one of the Lost Trades of York.

ROMAN ANTIQUITIES. No addition of importance has been made to the Roman Collection during the past year except the collection of glass collected by the late Mr. A. W

Linfoot, which has been acquired by purchase. The Honorary Curator hopes to complete during this year his Catalogue of objects in the lower room of the Hospitium.

GEOLOGY. The better specimens in the Tertiary section of the Reed Collection have been cleaned and re-arranged in the central geological room. The collection of bones from the Teesdale Cave, made by the late James Backhouse between the years 1878-1888, has been removed from the cabinet and is now open to inspection for the first time. It has been set out in the desk cases of the gallery, and consists mostly of remains of the smaller mammals and birds, thus supplementing the collection of Pleistocene vertebrates arranged last year on the ground floor. It includes the humerus of Lynx, figured and described by W. Davis in the GEOLOGICAL MAGAZINE for 1880, pl. xi, p. 346.

ZOOLOGY. All the cabinet Collections have been cleaned and re-labelled where necessary. A number of additions have been made to the vertebrates.

CONCHOLOGY. There have been no additions to the Conchological Collections during 1932. The building up of a type collection of British Land and Freshwater Shells is progressing, and it is hoped to complete the work during the coming year.

ASTRONOMY. The Telescope and Transit Instrument were thoroughly overhauled and revarnished during July, 1932, and they are now in first-class condition. A large number of observations have been taken. The partial eclipse of the moon on September 14th was observed under ideal conditions, the sky being clear for the whole evening.

BOTANY. The specimens of British Flowering Plants and Ferns in the Herbarium have been enclosed in new folders. Charts have been included in the folders showing the distribution and altitudinal range of the British Plants.

The Hon. Curator acknowledges the assistance received from the following works :—

WATSON, H. C.—Topographical Botany, 2nd. ed., 1883.

BENNETT, ARTHUR.—Topographical Botany, Supplement to, 1906.

BENNETT (ARTHUR), SALMON & MATTHEWS—Topographical Botany, Second Supplement to, 1929-30.

Druce, G. Claridge.—The Comital Flora of the British Isles, 1932.

Wilson, A.—The Altitudinal range of British Plants, 1931.

The donations consist of the collection of Mosses and Hepatics formed by the late Mr. George Webster, of York, and about two thousand specimens of British Flowering Plants from the Herbarium of the late Mr. William Bean, Junior, of Thirsk and Scarborough.

The British Flowering Plants have been removed from the end of the Students' Room to a more convenient place near the window. The Foreign specimens require careful attention and more room.

Numismatics. During this year the English Coins have had their temporary labels replaced by final labels (with detailed description where needful) under each coin, and all have been re-classified on the lines of Dr. G. C. Brooke's new book on English Coins. The completion of the work on Roman Coins after 193 A.D. is postponed owing to delay in publication of parts of the new standard book by Messrs. Mattingly & Sydenham. Preliminary work on Greek Coins and on Medals is now in progress. The Society has received some welcome gifts of coins throughout the year, but no important local finds have been reported.

Ceramics. The Ceramic Collections have been efficiently maintained during the past year, and a good deal of work expended upon them. The whole of the cases containing the Mediaeval Pottery have been cleaned and the wall-cases re-coloured ; the pottery has also been cleaned and re-arranged, and many of the important pieces have been labelled. A few interesting specimens have been added to the collections during the year. Considerable work has also been expended on the catalogue of the Mediaeval Pottery, an important section of which will, it is hoped, be ready, in manuscript form, before the end of the year.

Library. During the year 57 volumes have been added by purchase, and 45 by presentation, in addition to the usual unbound memoirs. The number of volumes borrowed was 291.

Meteorology. Statistics of Station : Longitude 1° 5′ W. ; Latitude, 55° 57′ N. ; height above mean sea level, 56 feet.

The rainfall for 1932 was below normal, being 24.91 inches, .60 inches below the average for over 50 years. The wettest months of the year were May, July, September, and October, when the totals for the months were: 5.66, 3.16, 2.00 and 2.82 inches respectively. February, August, November and December were the driest months with .36, 1.61, 1.49 and 1.12 inches respectively.

Temperature ranged from 84° F. on July 10th and August 11th to 24° F. on February 19th and March 3rd; the range of temperature for 1932 being thus: 60.0° F. as against 54.0° F. for 1931. A mean pressure of 1015.4 millibars (1,000 millibar=29.531 inches of mercury) at M.S.L. (corrected for diurnal variations), has been recorded as against 1014.3 millibars for 1931. October gave the lowest mean for the year, 1003.5 millibars, April next with 1006.4 millibars. February was highest, 1034.1 millibars, and August next with 1019.5 millibars. The extreme range was 1.96 inches as compared with 1.86 inches in 1931. The highest reading of the barometer was taken January 8th at 9 a.m., viz.: 30.95 inches, and the lowest on January 6th at 9 p.m., viz.: 28.95 inches.

Snow or Rain fell to the amount of 24.91 inches or 632.7 mm., as against 29.22 inches or 742.2 mm., for 1931, a decrease of 4.31 inches or 109.5 mm. for the year. The heaviest fall of the year occurred on May 21st, when 70.4 mm. (2.77 inches) fell. The cumulative totals for the years since 1820 are, for the heaviest monthly falls, August 6000.35 mms., October 5753.48 mms., and July 5432.30 mms.

Observations of Winds show that during 1932 we had "strong" winds on 6 days (force 4 to 7 on scale 0-12), 2 days less than 1931, and "calm" on 4 days as compared with 8 in 1931. The chief winds have been observed as S. (98), N. (83), W. (45), N.E. (43), S.W. (40), and N.W. (28).

Thunder was heard on 8 days, snow or sleet fell on 6 days, as against 32 days in 1931; and there were hailstorms on 11 days, as against 3 days the previous year.

Bright Sunshine was recorded 1090.2 hours as against 1324.8 hours in 1931, a decrease of 234.6 hours for the year.

The daily mean was 2.98 hours, and the percentage of possible sunshine 24 as against 30 in 1931.

The first five months of the year were very cold. Each month contained night frosts, and the fruit crop was destroyed in this district. Spring growths were rather late and vegetation did not make much progress. The hay crops were fairly good, also cereals in this district were, on the whole, very good, and were well gathered.

Potatoes were a fair crop, and were gathered well.

It is urgently requested that any discovery of Archæological interest in the neighbourhood may be brought to the notice of the Keeper of the Museum, or the Honorary Curators, as early as possible.

The Keeper of the Museum will be pleased to give any information in his power, and may be seen daily, Museum engagements permitting.

LIST OF SCHOOLS

AND OTHER ORGANIZATIONS THAT HAVE VISITED THE MUSEUMS DURING 1932 :—

April 16th.—Club and Institute Union Joint Education Committee (York Branch).
April 29th.—The Geographical Association (Bradford Branch).
May 6th.—The Geographical Association (Bradford Branch).
May 20th.—Durham University Historical Society.
May 20th.—Heaton Secondary School for Boys.
May 26th.—York Day School of Commerce.
May 27th.—Westoe School, South Shields.
May 28th.—Barlby Boy Scouts.
June 4th.—Birkenhead Boys' Secondary School.
June 8th.—The Yorkshire Archæological Society.
June 10th.—Sunderland Junior Technical School.
June 11th.—Seaton Delaval and Astley Central Schools.
June 11th.—Shiremoor Modern School.
June 14th.—Sheffield Adult School.
June 16th.—Fylde Rural Deanery Mothers' Union.
June 18th.—Batley Girls' Grammar School.
June 20th.—Heaton Secondary School.
June 22nd.—Snapethorpe School, Senior Department.
June 24th.—Burnley Grammar School.
June 25th.—Kinsley Council School.
June 27th.—Thurston Middle Class School.
July 1st.—Edgehill Training College.
July 1st.—Barnsley Senior Girls' School.
July 2nd.—Arnforth Council School.
July 2nd.—Castleford Grammar School.
July 2nd.—Doncaster Municipal High School.
July 5th.—Potteries Council School.
July 5th.—Leeds Reading Circle.
July 7th.—Leeds Blind Institute.
July 8th.—Huddersfield St. John's School.
July 9th.—Old Boys' Association, Hillhouse, Huddersfield.
July 13th.—West Hartlepool Central School.
July 15th.—East Retford Wesleyan School.
July 19th.—Hemsworth Council School.
July 22nd.—Royds Hall Secondary School.
July 27th.—Mickletown School.
Aug. 12th.—1st Hartlepool Girls' Brigade.
Sept. 5th.—Association for Reform of Teaching the Latin Language.
Sept. 7th.—Pontefract Girls' School.
Sept. 9th.—Girls from the College de Jeunes Filles, Peronne.
Sept. 15th.—Potteries School, Whitwood Mere.
Sept. 24th.—Temple Street, Castleford, Girls' School.
Sept. 24th.—Oxenhope Council School.
Oct. 1st.—Hulton Modern School.
Oct. 15th.—Skipton Council School.
Oct. 31st.—Norton Girls' School.

And many smaller parties.

CLIMATOLOGICAL SUMMARY—THE YORKSHIRE MUSEUM, YORK, 1932.

Heights above Ground :—Thermometers 4 ft. Rain-gauge 1 ft.

1932.	Air Temperature in Degrees Fahrenheit.											Earth Temperature		Rainfall.					Weather.						Bright Sunshine.		
	Means of		Means of Max. + Min.	Absolute Extremes.								At 1 ft.	At 4 ft.	Total.		Maximum Fall.		Day.	Number of Days of						Total.	Daily Mean.	Per cent.
	Max.	Min.		H. Max.	Day.	L. Min.	Day.	L. Max.	Day.	H. Min.	Day.								Precipitation 0.2 mm. r more.	Precipitation 1 mm. or more.	Snow.	Snow Lying.	Hail.	Thunderstorm.			
	° F.	° F.	° F.	° F.		° F.		° F.		° F.		° F.	° F.	in.	mm.	in.	mm.								hr.	hr.	%
Jan.	48.4	38.3	43.3	59	18	25	1	34	28	55	3	41.6	44.0	1.72	43.7	.64	16.3	6	10	8	0	0	0	0	46.0	1.48	19
Feb.	44.8	34.8	39.8	52	3	24	19	35	10	43	4,23	39.2	42.4	0.36	9.1	.10	2.5	13	10	3	2	2	0	0	63.6	2.19	23
March	47.7	35.2	41.5	56	28	24	3	42	2,11	43	28,30	40.3	42.0	1.69	42.9	.54	13.7	22	14	6	0	0	2	0	83.6	2.70	23
April	51.3	36.7	44.0	64	30	30	27	45	1,4	46	30	43.7	43.9	1.64	41.7	.34	8.6	25	22	12	3	0	1	0	120.7	4.02	29
May	57.1	43.6	50.3	68	14,18	30	8	47	6	53	20	50.7	47.7	5.66	143.8	2.77	70.4	21	23	13	1	0	0	3	100.4	3.24	20
June	65.5	48.1	56.8	74	11,17, 27	40	3,5	53	6	57	26	57.4	52.8	1.64	41.7	1.23	31.2	27	5	4	0	0	1	1	171.2	5.71	34
July	68.5	54.9	61.7	84	10	49	18	61	11,18, 27	61	10,11	60.8	56.5	3.16	80.3	.76	19.3	31	19	16	0	0	0	4	102.0	3.29	20
August	69.7	55.2	62.5	84	11	44	24	61	24,25, 29	63	12,18	62.0	58.4	1.61	40.9	.74	18.8	29	6	4	0	0	1	2	129.9	4.19	28
Sept.	63.1	48.1	55.6	76	16	31	29	55	20,27	62	14,15	57.4	57.8	2.00	50.8	.83	21.1	2	14	11	0	0	0	0	138.3	4.61	36
October	53.8	41.5	47.7	62	7	32	29	41	29	50	17	49.8	53.3	2.82	71.6	.43	10.9	21	22	17	0	0	3	1	74.6	2.41	23
Nov.	48.6	39.8	44.2	58	2	27	11	43	18,19	54	3	45.2	49.0	1.49	37.8	.29	7.4	15	17	11	0	0	0	0	28.2	0.94	11
Dec.	46.6	38.2	42.4	56	17,18	28	7	37	26	50	18	41.6	45.3	1.12	28.4	.24	6.1	29	17	9	0	0	0	0	31.7	1.02	14
Totals	665.1	514.4	589.8	—	—	—	—	—	—	—	—	589.7	593.1	24.91	632.7	—	—	—	179	114	6	2	8	11	1090.2	35.80	24
Means or Extremes	55.4	42.9	49.1	—	—	—	—	—	—	—	—	49.1	49.4	—	—	—	—	—	—	—	—	—	—	—	2.98	2.98	—

CLIMATOLOGICAL SUMMARY—THE YORKSHIRE MUSEUM, YORK, 1932.

Latitude 53° 57′ N. Longitude 1° 5′ W. Height above Mean Sea Level 56 ft.

1932.	Mean Pressure corrected to 32° F. and lat. 45° and reduced to Mean Sea Level.				Air Temperature		Humidity.						Mean Amount of Cloud, 0-10		Cloud Amount, 9 a.m.					Wind, No. of Observations, 9 a.m.											
							Depression of Wet Bulb.		Vapour Pressure.		Percentage.				No. of Observations.					(Beaufort Scale).				Direction.							
	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	9 a.m.	9 p.m.	0	1-3	4-6	7-9	10	8 or more.	4-7	1-3	Calm.	N	NE	E	SE	S	SW	W	NW
	mb.	mb.	in.	in.	° F.	° F.	° F.	° F.	mb.	mb.	%	%																			
Jan.	1015.3	1014.9	29.98	29.97	41.8	43.5	1.1	1.4	8.2	8.3	91	88	7.3	6.0	6	1	2	2	20	0	0	30	1	1	0	0	0	19	4	3	3
Feb.	1034.1	1033.9	30.54	30.53	38.0	39.2	1.8	1.6	6.5	6.9	83	85	7.1	6.8	3	5	1	6	14	0	0	28	1	14	6	0	2	1	0	2	3
Mar.	1015.0	1014.8	29.97	29.97	40.4	40.2	2.5	1.8	6.5	7.1	77	84	6.6	6.7	6	3	2	9	11	0	0	31	0	9	2	1	0	8	6	2	3
April	1006.4	1006.7	29.72	29.73	44.8	42.1	3.6	2.2	7.2	7.3	71	81	6.8	5.5	6	1	4	5	14	0	3	27	0	4	3	1	3	7	2	6	4
May	1011.1	1011.5	29.86	29.87	51.4	49.8	3.7	2.7	9.4	9.9	74	81	8.6	7.4	0	1	6	5	19	0	1	30	0	14	6	3	0	5	1	1	1
June	1019.4	1019.0	30.10	30.09	58.2	56.4	4.6	4.1	11.9	11.3	72	75	6.7	5.5	6	1	4	7	12	0	0	30	0	11	6	0	2	4	1	2	4
July	1011.0	1011.2	29.86	29.86	61.9	60.6	3.8	3.5	15.7	14.6	83	80	8.8	7.8	0	2	2	6	21	0	0	31	0	8	2	0	2	10	4	5	0
Aug.	1019.5	1019.4	30.11	30.10	62.4	61.3	3.7	2.9	15.0	15.2	79	83	8.1	6.8	2	3	1	7	18	0	0	31	0	6	6	2	1	3	3	8	2
Sept.	1011.6	1012.3	29.87	29.89	55.3	55.3	2.6	2.4	12.3	12.5	83	85	7.0	3.9	4	1	5	8	12	0	0	30	0	4	2	0	1	9	6	7	1
Oct.	1003.5	1003.0	29.63	29.62	46.3	45.8	1.7	1.3	9.1	9.5	87	90	7.7	5.0	3	3	2	3	20	0	1	29	1	6	1	0	0	8	7	3	5
Nov.	1017.2	1018.0	30.04	30.06	43.5	44.3	1.3	1.7	8.4	8.4	89	86	8.1	8.0	5	0	0	4	21	0	1	28	1	3	5	1	3	10	2	4	1
Dec.	1017.3	1017.1	30.04	30.04	41.7	42.1	1.1	1.1	8.2	8.2	91	91	7.7	7.4	5	1	1	4	20	0	0	31	0	3	4	0	3	14	4	2	1
Totals	12185.2	12186.4	—	—	585.7	580.6	31.5	26.7	118.4	119.2	980	1009	90.5	76.8	46	22	30	66	202	0	6	356	4	83	43	8	17	98	40	45	28
Means	1015.4	1015.5	29.98	29.99	48.8	48.4	2.6	2.2	9.9	9.9	82	84	7.5	6.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Pressure is expressed in millibars (1,000 millibars = 29·531 mercury inches), also in mercury inches.

RIVER HEIGHT RECORDS REGISTERED BY THE AUTOMATIC RECORDER AT THE GUILDHALL, YORK, 1932.

Date.	JANUARY.				FEBRUARY.				MARCH.				APRIL.				MAY.				JUNE.			
	Time.	Above or below S.L.			Time.	Above or below S.L.			Time.	Above or below S.L.			Time.	Above or below S.L.			Time.	Above or below S.L.			Time.	Above or below S.L.		
			ft.	in.			ft.	in.			ft.	in.			ft.	in.			ft.	in.			ft.	in.
1	12 p.m.	above	0	10	1 a.m.	above	0	7	2 p.m.	above	0	1	1 a.m.	above	3	1	1 a.m.	above	1	1	1 a.m.	above	1	11
2	6 p.m.		3	2	2 p.m.		0	7	9 a.m.	below	0	4	,,		1	9	12 p.m.		3	5	,,		1	2
3	12 p.m.		5	6	6 p.m.		0	6	,,		0	5	,,		1	2	9 p.m.		8	0	,,		0	10
4	11 a.m.		7	3	noon		0	4	1 a.m.		0	3	,,		0	11	1 a.m.		7	8	,,		0	8
5	1 a.m.		4	9	5 p.m.		0	5	10 a.m.		0	4	,,		0	6	,,		3	7	6 p.m.		0	6
6	12 p.m.		8	3	12 p.m.		0	4	5 p.m.	above	0	2	6 p.m.		0	4	12 p.m.		1	7	1 a.m.		0	5
7	4 p.m.		9	4	,,		0	4	1 p.m.		0	3	12 p.m.		1	2	1 a.m.		1	7	1 p.m.		0	3
8	1 a.m.		8	8	1 a.m.		0	4	9 p.m.		2	6	6 p.m.		1	6	4 p.m.		1	3	1 a.m.		0	3
9	,,		4	1	12 p.m.		0	4	1 a.m.		2	4	1 a.m.		1	5	2 p.m.		1	0	1 p.m.		0	1
10	12 p.m.		4	9	3 p.m.		0	6	,,		0	10	12 p.m.		7	0	1 a.m.		1	0	noon		S.L.	
11	3 p.m.		7	6	12 p.m.		0	3	,,		0	5	4 a.m.		7	2	noon		0	6	12 p.m.	above	0	1
12	1 a.m.		6	11	,,		0	7	12 p.m.		0	2	1 a.m.		3	4	12 p.m.		0	6	5 p.m.		0	3
13	12 p.m.		6	0	noon		0	7	5 p.m.		0	2	,,		1	4	5 p.m.		2	11	1 p.m.		0	3
14	5 a.m.		6	8	12 p.m.		0	9	12 p.m.		0	2	,,		0	9	1 a.m.		2	7	noon	below	0	3
15	1 a.m.		4	6	3 p.m.		1	0	7 p.m.		0	3	6 p.m.		1	2	,,		1	7	,,		0	3
16	12 p.m.		4	3	1 a.m.		0	11	6 p.m.		0	2	1 a.m.		0	11	12 p.m.		0	9	10 a.m.		0	6
17	,,		6	10	2 p.m.		0	8	1 a.m.		0	1	4 p.m.		0	9	noon		1	3	noon		0	4
18	3 a.m.		7	0	noon		0	6	10 p.m.		0	1	1 a.m.		0	6	1 a.m.		0	10	2 p.m.		0	5
19	1 a.m.		3	8	6 p.m.		0	5	noon	below	0	5	4 p.m.		0	3	,,		0	5	6 a.m.		0	6
20	,,		2	3	4 p.m.		0	6	5 p.m.	above	0	2	12 p.m.		0	3	12 p.m.		0	7	1 a.m.		0	6
21	,,		1	7	12 p.m.		0	6	1 a.m.	below	0	4	,,		0	8	,,		1	5	noon		0	6
22	,,		1	3	,,		0	6	12 p.m.	above	0	8	,,		1	1	,,		7	2	12 p.m.		0	7
23	noon		1	0	,,		0	6	4 p.m.		3	1	1 a.m.		1	1	6 a.m.		8	7	noon		0	9
24	4 p.m.		1	0	2 p.m.		0	7	1 a.m.		2	6	5 p.m.		1	7	1 a.m.		7	3	12 p.m.		0	9
25	1 a.m.		0	9	10 p.m.		0	7	,,		0	11	1 a.m.		1	2	,,		3	9	10 a.m.		0	9
26	9 p.m.		0	10	3 p.m.		0	6	4 a.m.		0	8	,,		0	6	,,		1	9	noon		1	0
27	noon		0	8	7 p.m.		0	6	5 p.m.		0	6	12 p.m.		1	0	12 p.m.		2	6	11 p.m.	River drawn off	4	1
28	,,		0	8	5 p.m.		0	5	12 p.m.		0	6	1 a.m.		1	0	8 p.m.		3	9	3 p.m.		4	6
29	10 p.m.		0	8	1 p.m.		0	3	,,		1	6	12 p.m.		1	3	12 p.m.		3	11	1 a.m.		3	7
30	6 p.m.		0	9					,,		5	5	3 a.m.		1	4	noon		4	1	11 a.m.		2	9
31	,,		0	8					1 a.m.		5	5					1 a.m.		3	2				

RIVER HEIGHT RECORDS.—Continued.

Date.	JULY.				AUGUST.				SEPTEMBER.				OCTOBER.				NOVEMBER.				DECEMBER.			
	Time.	Above or below S.L.	ft.	in.	Time.	Above or below S.L.	ft.	in.	Time.	Above or below S.L.	ft.	in.	Time.	Above or below S.L.	ft.	in.	Time.	Above or below S.L.	ft.	in.	Time.	Above or below S.L.	ft.	in.
1	12 p.m.	above	0	10	1 a.m.	above	2	7	10 a.m.	below	0	8	noon	below	0	8	1 a.m.	above	2	1	1 p.m.	above	5	1
2	6 a.m.		1	1	2 p.m.		1	1	12 p.m.	above	2	7	6 p.m.	above	0	9	4 p.m.		1	6	,,		3	10
3	1 a.m.		0	3	1 a.m.		0	8	3 p.m.		4	11	1 a.m.		0	7	12 p.m.		3	3	noon		4	2
4	12 p.m.		0	2	,,		0	3	1 a.m.		3	11	6 a.m.	below	0	4	5 a.m.		3	4	1 a.m.		3	3
5	4 p.m.		1	4	8 a.m.	below	0	5	,,		1	3	noon		0	5	1 a.m.		1	8	,,		2	11
6	1 a.m.		0	4	,,		0	6	12 p.m.		0	1	,,		0	8	,,		0	10	,,		1	2
7	,,		0	1	,,		0	9	2 p.m.		0	6	,,		0	8	,,		0	5	12 p.m.		0	10
8	12 p.m.	below	0	5	1 a.m.		0	7	noon		0	3	8 a.m.		0	10	12 p.m.		0	2	1 a.m.		0	9
9	11 a.m.		0	7	8 a.m.		0	8	6 p.m.		3	8	6 p.m.	above	5	2	noon		0	2	,,		0	4
10	noon		0	10	,,		0	8	1 a.m.		3	1	1 a.m.		4	2	,,		0	2	12 p.m.		0	6
11	2 a.m.		0	8	9 a.m.		0	9	12 p.m.		1	10	12 p.m.		1	9	1 a.m.		0	2	,,		0	8
12	12 p.m.	above	1	2	10 a.m.		0	8	11 a.m.		3	3	noon		2	5	noon		S.L.		,,		0	11
13	1 a.m.		1	1	11 a.m.		0	8	1 a.m.		1	6	1 a.m.		1	8	12 p.m.	above	0	2	1 a.m.		0	9
14	9 p.m.		0	4	4 p.m.		0	10	12 p.m.		0	8	9 p.m.		2	9	6 p.m.		0	3	12 p.m.		0	7
15	1 a.m.		0	3	1 a.m.		0	8	9 a.m.		0	11	1 a.m.		2	7	12 p.m.		0	2	,,		0	11
16	9 a.m.	below	0	5	8 a.m.		0	11	1 a.m.		0	4	,,		1	3	2 p.m.		0	5	5 p.m.		1	10
17	7 a.m.		0	9	10 a.m.		1	0	10 p.m.	below	0	6	2 a.m.		0	6	1 a.m.		0	5	10 p.m.		4	3
18	1 a.m.		0	7	,,		1	0	12 p.m.		0	7	12 p.m.		2	4	,,		0	4	1 a.m.		4	2
19	10 a.m.		0	6	,,		1	0	1 a.m.		0	7	6 a.m.		2	6	4 p.m.		0	1	,,		1	4
20	noon		0	5	noon		1	0	noon		0	8	1 a.m.		1	1	6 p.m.		0	1	12 p.m.		0	7
21	,,		0	5	,,		1	0	12 p.m.		0	7	12 p.m.		1	2	2 a.m.		0	2	noon		0	6
22	,,		0	6	4 p.m.	above	0	1	noon		0	7	,,		7	0	9 a.m.	below	0	4	12 p.m.		0	6
23	,,		0	5	2 a.m.		0	1	,,		0	7	9 a.m.		8	0	3 p.m.	above	2	9	,,		0	9
24	6 a.m.		0	6	10 p.m.	below	0	7	,,		0	8	1 a.m.		5	10	8 a.m.		2	1	,,		0	11
25	11 p.m.	above	0	3	,,		0	7	10 a.m.		0	9	,,		2	9	10 a.m.		2	2	4 p.m.		1	0
26	2 p.m.		0	8	11 p.m.		0	8	3 a.m.		0	8	3 p.m.		2	5	12 p.m.		2	8	noon		0	5
27	,,		0	1	10 a.m.		0	9	noon		S.L.		6 a.m.		2	1	11 a.m.		3	7	,,		0	3
28	11 a.m.		3	0	12 p.m.		0	8	2 p.m.	below	0	5	1 a.m.		1	6	1 a.m.		3	1	,,		0	4
29	1 a.m.		1	8	1 a.m.		0	8	6 p.m.		0	6	,,		1	4	,,		1	9	1 p.m.		0	6
30	12 p.m.		2	0	8 a.m.		0	6	4 p.m.		0	8	12 p.m.		1	10	12 p.m.		2	11	12 p.m.		1	2
31	5 p.m.		3	3	10 a.m.		0	3					noon		2	10					10 a.m.		1	7

THE YORKSHIRE MUSEUM, 1932.

Month.	Bright Sunshine.			Pressure at Mean Sea Level.					
	Daily Mean. 1932.	Percentage.		Absolute.					
		1931.	1932.	Highest.	Date.	Time.	Lowest.	Date.	Time.
	hr.	%	%	mb.			mb.		
Jan.	1.48	26	19	1045.8	26th	9 am	977.0	6th	9 pm
Feb.	2.19	17	23	1045.5	20th	9 pm 9 pm	1021.4	24th	9 am
Mar.	2.70	40	23	1028.6	15th	9 am	987.5	30th	9 am
Apr.	4.02	30	29	1030.7	13th	9 am	982.9	2nd	9 am
May	3.24	35	20	1020.5	18th	9 am	1003.8	9th	9 am
June	5.71	28	34	1028.0	15th	9 am	1000.9	30th	9 pm
July	3.29	27	20	1023.1	9th	9 am	993.3	1st	9 am
Aug.	4.19	40	28	1030.9	24th	9 am	1008.2	30th	9 am
Sept.	4.61	25	36	1031.5	28th	9 am	992.1	11th	9 am
Oct.	2.41	41	23	1022.1	19th	9 am	985.0	8th	9 pm
Nov.	0.94	14	11	1039.1	13th	9 am	995.4	23rd	9 am
Dec.	1.02	19	14	1040.6	25th	9 am	989.2	2nd	9 pm
Year.	35.80 2.98	30	24	1045.8	Jan. 26th	9 am	977.0	Jan. 6th	9 pm

RAINFALL IN 1932
AT CHERRY HILL, YORK.

Rain Gauge: Dia. of Funnel, 5 in.;
Height above Ground, 1 ft. 6 in.
,, ,, Sea level, about 50 ft.

Month.	Inches.	Wet Days.	Greatest Fall.	Date.
Jan.	1·70	9	·52	6
Feb.	·35	6	·07	9
Mar.	1·73	8	·44	22
April	1·39	14	·36	21
May	5·29	16	2·71	21
June	1·62	4	1·37	27
July	2·81	18	·38	11
Aug.	1·85	5	·78	29
Sept.	2·71	14	·80	14
Oct.	2.69	17	·45	25
Nov.	1·34	16	·26	15
Dec.	1·05	14	·24	30
Totals	24·53	141		

ADDITIONS TO THE MUSEUM

During 1932.

Allen, E.—Mounted specimen of Pied Linnet.

Anonymous.—Wooden block, found during excavations in the Water Tower of St. Mary's Abbey, Marygate, Nov., 1931.

Buckthought, Geo.—Specimen of Antimony tetroxide, Sb_2O_4, with quartz from N.W. Australia.

Catton, Mrs. M. A.—Framed Engraving of a slave.

Clark, T.—One Edward III half groat, two XVIIth century tokens, all found in York.

Cooper, J. A.—Two red " screw-neck " single-handled Roman Flagons, and one Cinerary Urn in coarse grey ware, 2nd century. (From Rawcliffe Lane, York.)

Davis, The Misses.—Metacarpal of *Bos primigenius* from submerged forest, Easington.

Dickinson, Thos.—$\frac{3}{4}$ of farthing, Wm. III.

Edmondson, F. H.—Skin of Partridge, var. *cinerea*.

Elmhirst, Chas. E., J.P.—Albino variety of the Brown Rat ; Photograph and specimen of the middle toe of the Bittern and photograph of middle toe of Heron.

Fenton, J. C.—Pewter Bowl (probably christening).

Greg, Mrs. A.—Wooden dressed figure of " Bob," a York Bellman.

Hammond, Miss.—Early hand-painted Portrait of John Sanderson, York.

Hardacre, J.—Coin Weight ; English Brass Weights.

Hobson, The Late Mr. (of Easingwold).—Series of Yorkshire Fossils, Mediaeval Tiles, 1 Celt and 1 Flint Scraper.

Howard, Guy and—Walker.—Three handles of green glazed Pottery ; part of skull and bones of Ox ; horn of Deer, and bone Awl.

Hurst, Arthur, A.K.C.—Two Newark Siege Pieces—2/6 and 9d.

Kendall, Prof. P. F., D.Sc., F.R.S., F.G.S.—34 Lantern Slides taken by the late Dr. Tempest Anderson, together with 102 of those illustrative of American glacial geology.

Morton, J. H.—Victoria Penny, 1847; Edward VII Farthing, 1909; Ceylon $\frac{1}{4}$ cent, 1870.

Ogden, James R., J.P., F.S.A.—Cheque on the York Bank, dated March 27th, 1787.

Phillips, The Rev. W.—Stone Hand Axe from Murray River, North Australia.

Rees, The Rev. W. D. Wood.—Two Tortoiseshell Pin Boxes.

Rothschild, The Rt. Hon. Lord.—Serrated Flint Scraper from Malton.

Sheppard, Mrs.—Stuffed Fox (E. coll. George Bowman).

Smith, Sydney H., F.Z.S.—Coot in flesh; Neck of large Cinerary Urn; Roman fumed ware; Woodcock shot at Raskelf.

Sowden, H.—Galls formed by *Livia juncorum* on *Juncus articulatus.*

Thompson, Mr. & Mrs. Geoffrey.—Pewter Tankard made by Edmond Harvey, York, 1714—1720.

Tissiman, W. H.—Model of the Sailing Ship "Baticola."

Triffitt, J.—Pair of Scales and Weights.

Wheeler, G. Owen.—Collection of Mediaeval Tiles.

White, Miss M.—21 Lantern Slides of Skye, made by the late Dr. Tempest Anderson.

Wilkinson, H. J.—44 parcels of British and Foreign Mosses and Hepatics from the Herbarium of the late Mr. George Webster, of York; Deal Herbarium Cabinet with 14 shelves; 28 parcels containing about 2,000 specimens of British Flowering Plants.

ON LOAN.

Collins, Major E. R.—Collection of Palæolithic Specimens from the upper part of Nidderdale.

Hurst, A., A.K.C.—Collection of York Silver Plate.

Walker, S., F.E.S.—Early edition of Spenser's "Faerie Queene."

ADDITIONS TO THE LIBRARY

During 1932.

Anonymous.—" The New Museum " (J. C. Dana); " The Gloom of the Museum " (J. C. Dana).

Archey, Gilbert (Director of Auckland Institute and Museum, N.Z.).—" The Piraunui Pa at Matawhana Waikato " (L. W. Delph and Gilbert Archey); " Notes on Sub-Fossil Bird Remains " (Gilbert Archey); " Rock Shelter Drawings at Arapuni Gorge " (Gilbert Archey).

Ashmolean Natural History Society of Oxfordshire.—Proceedings and Report for 1931.

Auckland Institute and Museum, N.Z.—Annual Report, 1931-32; Records, vol. I, nos. 2, 3; Guide to the Exhibition of Chinese and Japanese Art.

Australian Museum.—Annual Report for year ended 30th June, 1931.

Belfast Natural History and Philosophical Society.—Proceedings and Reports, Session 1930-31.

Boston, Mass., U.S.A.—Bulletin of the Society for the Preservation of New England Antiquities (" Old-time New England "), Vol. xxii, nos. 3, 4; xxiii, nos. 1, 2.

Brighton and Hove Natural History and Philosophical Society.—Annual Report for years ending 30th June, 1931, and 30th June, 1932 (1 vol.).

Bristol Naturalists' Society.—Annual Report and Proceedings, 4th Series, Vol. vii, part iv. (1931).

Buteshire Natural History Society.—Transactions, 1930; " Notes on some Archæological Sites in Bute." (Presented by J. N. Marshall, M.D., F.S.A. (Scot.)).

Cahill, R. S.—Journal of the Chemical Society, January—December, 1932; British Chemical Abstracts, January—December, 1932; " The Life and Work of Professor William Henry Perkin, M.A., Sc.D., Ph.D., F.R.S."; " Discussion on the Critical Increment of Homogeneous Reactions."

California, State of.—Monthly Bulletin of the Department of Agriculture, vol. xx, nos. 10-12; xxi, nos. 1-3, 7-9.

California Fish and Game.—Vol. 18, nos. 1, 2.

California.—University of California Publications in Geology, 35 parts ; Vol. 22, nos. 1, 2.

Cardiff, National Museum of Wales.—" Changes in the Fauna of Wales within Historic Times" (by Colin Matheson, M.A., B.Sc.).

Chicago, U.S.A.—The Oriental Institute of the University of Chicago.—" In Commemoration of the Dedication of the Oriental Institute Building, December 5th, 1931."

China (Shanghai).—Contributions from the Biological Laboratory of the Science Society of China.—Vol. vii (Zoological Series), nos. 4-10.

Colchester and Essex Museum.—Annual Report, 1931.

Cooper, T. P.—" Roman (and other) Triple Vases " (W. J. Kaye, Jun., B.A., etc.).

Croydon Natural History and Scientific Society.—Proceedings, vol. x, pp. 116-166 (Feb., 1929,—Jan., 1931).

Dublin, National Museum of Ireland.—Report for 1929-30.

Dunstable Library and Museum.—7th Annual Report (Museum), (1931-32).

Edinburgh, Royal Society of.—Proceedings, vol. li, part iii ; lii, parts i-iv ; Transactions, vol. lvii, part i.

Fox, Cyril, Ph.D., F.S.A. (author).—"A Survey of McGill University Museums " (Montreal, 1932) ; " The Personality of Britain : its influence on inhabitant and invader in prehistoric and early historic times."

Gayner, J. S.—" The Birds of Surrey " (J. A. Bucknill) ; " The Sheep and its Cousins " (R. Lydekker, F.R.S.).

Glasgow Naturalist, The.—Vol. x, parts i and ii.

Hawaiian Volcano Observatory.—The Volcano Letter, nos. 361-391 ; Index for 1931.

Horticultural Society, The Royal.—Report for 1931 ; Journal, vol. lvii, parts i and ii.

Hull Museum.—Publications, nos. 174-177.

Illinois State Geological Survey.—Report of Investigations, No. 24.

India (Calcutta).—Geological Survey of India.—Records, vol. lxv, part 4 ; lxvi, part 1 ; Memoirs, vol. lvii, lxi ; Index to vols. i-liv (1859-1929) ; Memoirs (Palæontologia Indica), New Series, vol. xviii, xx (mem. nos. 1-3).

JAPAN, NATIONAL RESEARCH COUNCIL OF.—Japanese Journal of Zoology.—Vol. iii (Contents) ; iv, nos. 1-3.

LEEDS PHILOSOPHICAL AND LITERARY SOCIETY.—Proceedings, Literary and Historical Section, vol. ii, parts vii, viii ; Scientific Section, vol. ii, parts vi, vii.

LEEDS, UNIVERSITY OF.—27th Report (1930-31) ; Publications and Abstracts of Theses during Session 1930-31.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY.—Transactions, vol. xxxiii (1931-32).

LEICESTER MUSEUM, ART GALLERY AND LIBRARY.—Bulletin (Quarterly), nos. 31-34.

LEIPZIG. -- Geologisches Zentralblatt. — Abteilung B :—Palæontologie—Band 1, no. i.

LONDON, BRITISH MUSEUM.—" Medallic Illustrations of the History of Great Britain and Ireland "—Plates i-clxxxiii and General Indexes. (19 parts).

— BRITISH MUSEUM (Natural History).—Index animalium, parts xxv, xxvi ; Summary Guide to the Exhibition Galleries ; Illustrated General Guide to the Exhibition Galleries ; Special Guide, no. 8.—Guide to an Exhibition illustrating the early history of Palæontology ; Special Guide, no. 9.—A Short History of the Collections.

— GEOLOGICAL SOCIETY OF.—Quarterly Journal, vol. lxxxviii, parts 1-4 (349-352) ; Geological Literature added to the Geological Society's Library during 1931.

— H.M. STATIONERY OFFICE.—Quarterly Return of Marriages, Births and Deaths, nos. 332-335.

— METEOROLOGICAL OFFICE.—Monthly Weather Reports, Supplements, etc., etc.

— THE NATIONAL CENTRAL LIBRARY.—16th Annual Report (1931-32).

— ZOOLOGICAL SOCIETY.—Proceedings, part 4, 1931 ; parts 1-3, 1932 ; Transactions, vol. xxi, part 4 (1931).

MANCHESTER, JOHN RYLANDS LIBRARY.—Bulletin, vol. 16, nos. 1, 2.

— LITERARY AND PHILOSOPHICAL SOCIETY.—Memoirs and Proceedings, vol. 63, 67 (part ii), 72, 73, 75.

MANCHESTER MUSEUM.—Report for 1931-32 (Museum Publication, no. 102).

MELMORE, S., B.Sc., F.G.S.—Proceedings of the Yorkshire Geological Society, vol. xix, part iii.

MEXICO, INSTITUTO GEOLOGICO DE.—Boletin num. 50.

MONTEVIDEO.—Anales del Museo de Historia Natural de Montevideo.—Serie II, Tomo iii, Entrega 2, 3a.

NATAL MUSEUM.—Annals of, vol. vii, part 1.

NEW YORK ACADEMY OF SCIENCES.—Annals of.—Vol. xxxii (pp. 221-234) Index to vol. xxxii; vol. xxxiii (pp. 1-26, 27-75, 77-232, 232-282).

NEW YORK PUBLIC LIBRARY.—Bulletin, vol. xxxvi, nos. 1-3.

NORTHANTS. NATURAL HISTORY SOCIETY AND FIELD CLUB.—Journal, vol. xxvi, nos. 205, 206.

NORTHUMBERLAND, DURHAM AND NEWCASTLE-ON-TYNE NATURAL HISTORY SOCIETY.—Report for 1931-32; Transactions, (New Series), vol. viii; The Hancock Museum Bulletin, Nos. 1 (April) and 2 (November), 1932.

NORWAY, BERGEN MUSEUM.—Arsberetning, 1930-31; Bergens Museums Arbok, 1930, 3 Hefte; 1931, 3 Hefte.

— OSLO METEOROLOGICAL INSTITUTE.—Jahrbuch des Norwegischen Meteorologischen Instituts 1930, 1931; Nedboriakttagelser I Norge, Argang xxxvi, xxxvii; Arsberetning, July, 1929-June, 1930; July, 1930-June, 1931; July, 1931-June, 1932; Oversikt over Luftens Temperatur og Nedboren I Norge, 1 Aret, 1929, 1930, 1931; Radiovaer, 1931, 1932; Skrifter om Svalbard og Ishavet, nr. 51.

— TROMSO MUSEUM.—Arsberetning, 1928-31; Arshefter, vol. 50 (1927); 51, parts 1-4 (1928).

NOVA SCOTIAN INSTITUTE OF SCIENCE.—Proceedings, vol. xviii, part 1 (1930-31).

OXFORD, UNIVERSITY MUSEUM.—Annual Report (1931).

PERTHSHIRE SOCIETY OF NATURAL SCIENCE.—Transactions and Proceedings, vol. ix, part 2 (1930-31).

ROCHESTER, N.Y.—ROCHESTER ACADEMY OF SCIENCE.—Proceedings, vol. vii, nos. 2, 3.

ROBINSON, ARTHUR E.—The Journal of the Antiquarian Association of the British Isles, vol. ii, no. 3—(including an Article on " False and Imitation Roman Coins," by Arthur E. Robinson).

SALISBURY, SOUTH WILTS. AND BLACKMORE MUSEUM.—Annual Report, 1931-1932.

SEABY, MESSRS. B. A., LTD.—" The Pipe Rolls and ' Defalta Monetariorum ' " (W. C. Wells).

SHEFFIELD LITERARY AND PHILOSOPHICAL SOCIETY.—109th Annual Report (1931).

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BRITISH MUSEUM
19 APR 33
NATURAL HISTORY.

PROCEEDINGS

OF THE

YORKSHIRE

PHILOSOPHICAL SOCIETY.

PAPERS

RELATING TO THE

Antiquities and Natural History of Yorkshire, etc.

PRINTED BY ORDER OF THE COUNCIL.
1933.

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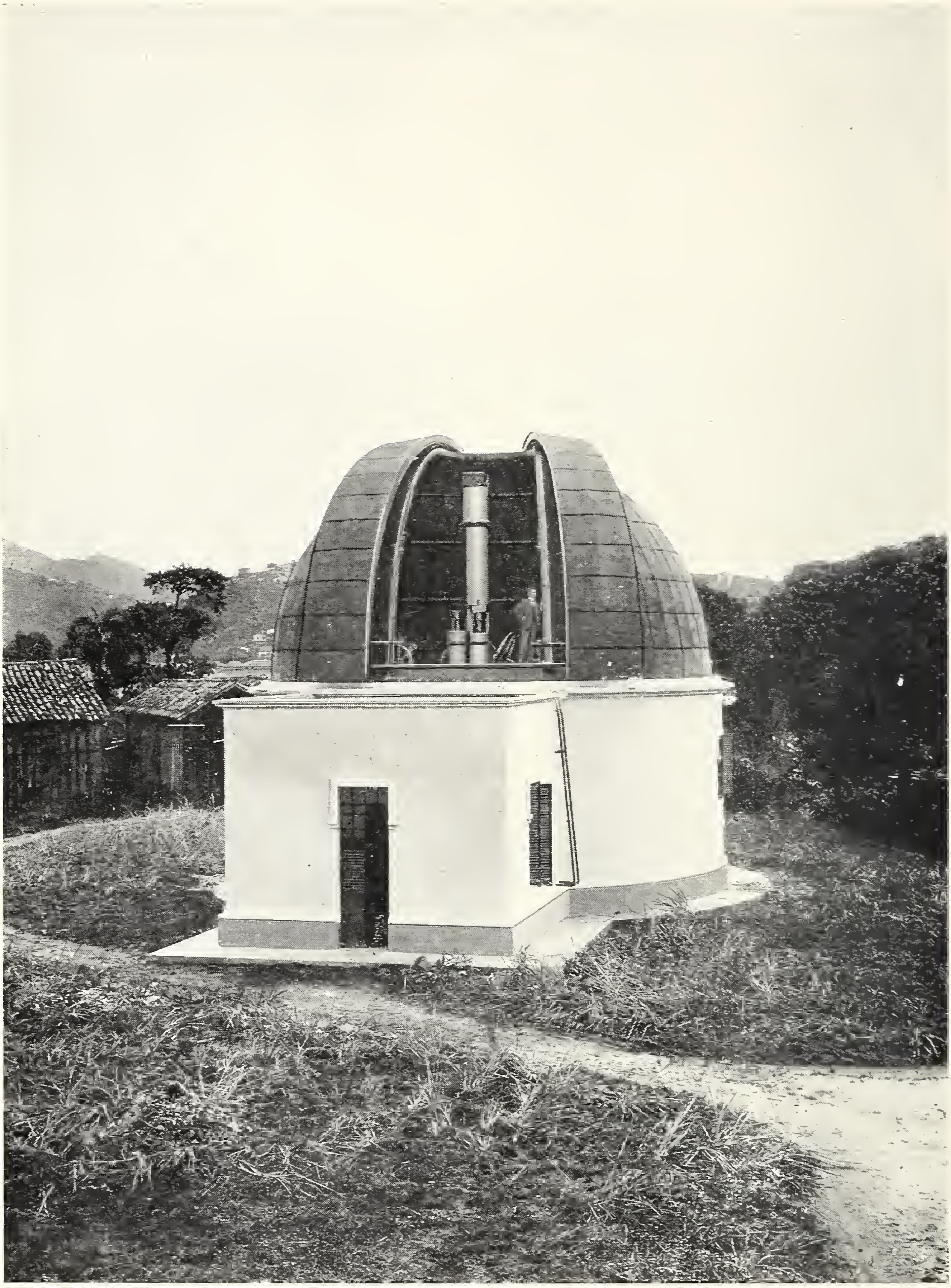

DOME 34 FEET DIAMETER WITH DOUBLE SHUTTERS.
ERECTED AT THE OBSERVATORIO NACIONAL RIO DE JANEIRO, BRAZIL.

PROCEEDINGS
OF THE
YORKSHIRE PHILOSOPHICAL SOCIETY,
1932.

THE ADJUSTMENTS OF AN EQUATORIAL MOUNTING FOR ASTRONOMICAL TELESCOPES.

By John Scott,
Honorary Curator of Astronomy, The Yorkshire Museum, York.

INTRODUCTION.

THE earliest record of an Observatory at York is in the Manuscript books of Edward Pigott, in the possession of the Yorkshire Philosophical Society. In these, he gives a full description of his observatory and instruments, and states "the whole was completed in 1781."

Another manuscript book, also in the Museum, is by John Goodricke, who in 1782, at York, observed "Algol" or B. Persei, and found it to be a variable star.

When the British Association held its original meeting in 1831 at York, one of the visitors was Dr. Pearson, who at that time was Vice-President of the Royal Astronomical Society, and while attending the meeting he promised the Yorkshire Philosophical Society that if they would build an observatory he would present them with two of the best instruments in his possession. The observatory was built in 1832, and shortly after the instruments which Dr. Pearson gave were installed, viz., an Equatorially mounted Telescope of 4 inches aperture, and a Transit Instrument. He also added with his gifts a Sidereal Clock by Barraud, and the conical revolving roof for the observatory. This roof was constructed under the direction of the celebrated Smeaton, and had served as a roof of a summer-house in Dr. Pearson's garden at his rectory at South Kilworth in Leicester. The clock and revolving roof of the observatory are still in good condition and constant use. The telescope has been superseded by a 4.25 inch aperture telescope on an equatorial mounting driven by suitable clockwork. This instrument was made, erected, and adjusted in 1868 by Mr. T. Cooke, the founder of the firm of Messrs. T. Cooke & Sons. This instrument is in good condition, and observations are taken with it at the present time.

The late Earl of Rosse, the constructor of the gigantic telescope with a speculum mirror, six feet in diameter, was born in York on June 17th, 1800. At the second meeting of the British Association in York in 1844, Lord Rosse exhibited a model of his magnificent instrument, and gave interesting details of its construction.

At the twenty-third meeting of the British Association at Hull in 1853, Professor Phillips, who for a number of years was Keeper and Secretary to the Yorkshire Philosophical Society, and resided at St. Mary's Lodge, York, read a paper on "Photographs of the Moon," in which he stated "But they" (that is the other Astronomers) "had not mounted their telescopes equatorially, and in the meantime I thought it useful to try the power of my own 6¼ inch achromatic, the work of our excellent artist Cooke, which is driven equatorially by very equable clock movement in the open air." Describing this equipment in a paper "On the Surface of the Moon," which he read before the Royal Society on January 16th, 1868, he states "With this excellent arrangement I was enabled to use photography very successfully, and to obtain selenographs 2 inches across in 5 minutes of time."

Professor Phillips does not describe how he adjusted his telescope, and in the manuscript books in the Museum there is no mention of the method Messrs. Pigott and Cooke used for the adjustment of their instruments, and among the numerous excellent text-books on Astronomy, the number of these which are informative about the erection and adjustment of the mountings is very limited, and they are not always readily available.

The following pages have been written with the object of assisting the amateur astronomer in the accurate adjustment of his mounting. I am indebted to Messrs. Cooke, Troughton, & Simms Ltd. for the loan of the blocks for the illustrations, also to Dr. William J. S. Lockyer, the Director of the Norman Lockyer Observatory, Sidmouth, Devon, for his kind permission to use his notes for the "Alternative stellar method of adjustment," and in conclusion I beg to express my thanks to two or three friends for their kind assistance in reading over the proof sheets.

ADJUSTMENTS OF AN EQUATORIAL MOUNTING FOR ASTRONOMICAL TELESCOPES.

THE earliest observations made by Astronomers led them to believe that the Sun and Stars were revolving round the Earth. This we know is not correct, for Copernicus (1473-1543) believed that the Earth rotated on its axis, and this was proved by the French physicist, Foucault, with his famous pendulum experiment at the Pantheon at Paris in 1851, and it is the diurnal rotation of the Earth on its axis from West to East which causes the apparent movement of the celestial bodies from East to West.

To observe a celestial object, the astronomer uses a telescope, and this is carried on a mounting in such a manner that it is possible to counteract the apparent movement and keep the object in the field of view. To do this it is essential that the mounting should have two axes of rotation at right angles to each other.

There are two types of mountings: the ALTAZIMUTH and EQUATORIAL.

THE ALTAZIMUTH MOUNTING. Fig. 1. On this mounting, the telescope is arranged to turn in Azimuth on a vertical axis, and in Altitude on a horizontal axis. With this type of mounting, both axes must be slowly rotated at the same time to keep the Sun or Stars in the field of view; further, the speed of rotation varies, being much quicker for an object on or near the celestial equator than for an object near the celestial pole. Thus it is useless to fit a uniform clockwork drive to either of the axes, and both hands must be employed to keep the object in view.

THE EQUATORIAL MOUNTING. On this mounting, one of the axes is set parallel to the Earth's axis, and is called the Polar Axis, see Fig. 2. In the Northern Hemisphere, it must be accurately set to point to the North Celestial Pole, and in the Southern Hemisphere to the South Celestial Pole.

The mode of adjustment for this axis is described later on.

The other axis at right angles to the Polar Axis, and enabling the telescope to be elevated or depressed, is called the Declination Axis, see Fig. 2. This axis is set parallel to the terrestrial equator. In good mountings of this type, both axes are fitted with graduated circles, which can be read against zero points, and by which their angles of rotation can be determined.

The rotation of the polar axis having to coincide with the daily apparent rotation of the heavens, this axis is provided with a time circle which is graduated to read hours, minutes, and seconds of time. It is known as the hour circle.

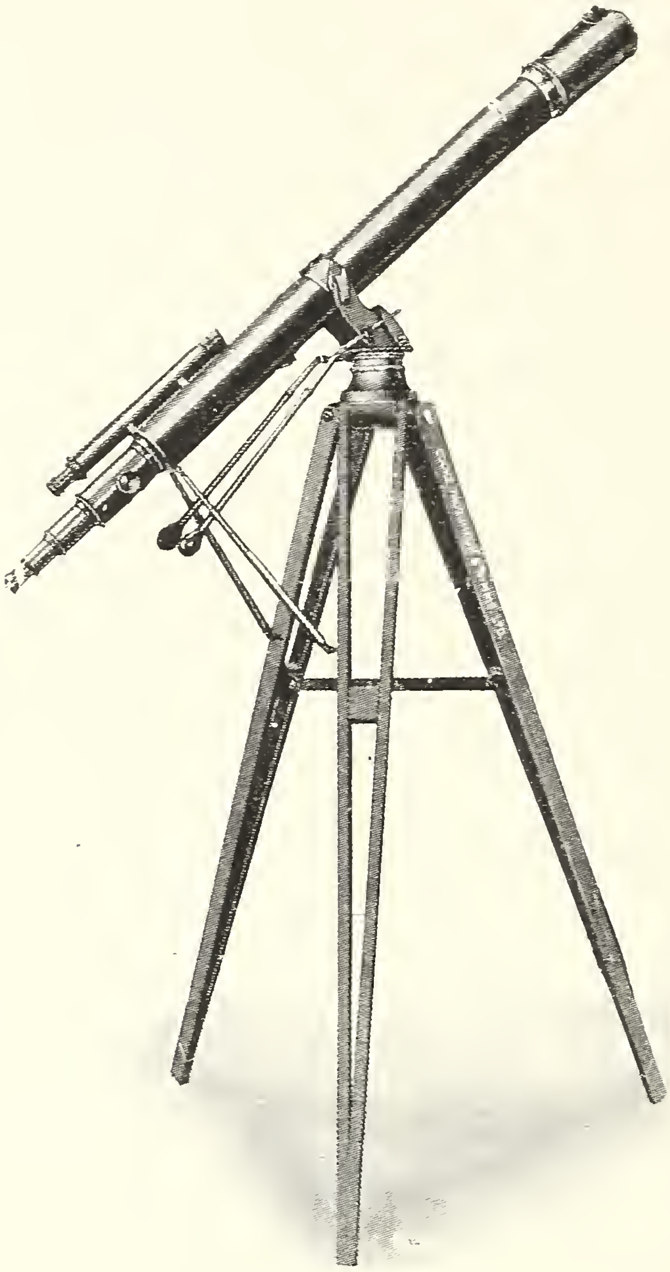

Figure 1
ALTAZIMUTH MOUNTING.

The circle on the declination axis is graduated to read degrees, minutes, and seconds of arc. It is known as the declination circle and indicates the declination of the celestial body.

In order to keep a star in the field of view with a telescope on an equatorial mounting, only the polar axis has to rotate, and it must rotate at the same speed for any star, whether near the equator or near the pole, since all stars have the same angular velocity, and clockwork is usually fitted to rotate the axis. The observer's hands are thus free to manipulate any of the accessories of the telescope such as micrometer, spectroscope, etc.

The rate of rotation of the polar axis, when the telescope is in use on the stars, is the same as the Earth's rotation on its axis, viz., one revolution in 23 hrs. 56 ins. 4.091 secs. of Mean Solar Time, i.e., Greenwich Mean Time (G.M.T.).

The three general types of equatorial mountings are the German or Fraunhofer in Fig. 2, the English in Pl. I., fig. 3, and the Astrographic in Pl. II., fig. 4.

The German Type of Mounting is supported on a single pillar. It is not possible with it to keep all stars under observation from their rising to their setting, because the eye end of the telescope fouls the pillar. It is therefore necessary when stars at certain altitudes approach the meridian to reverse the telescope by bringing it from one side of the pillar to the other. When observing a star which is on the East side of the pillar, the telescope should be on the West side, and when the star has passed the meridian, the telescope should be turned over to the East side of the pillar. This means rotating the polar axis through 12 hours. The declination axis, too, must be rotated through 180 degrees. From this, it will be seen that a star can usually be observed from two positions, and advantage of this reversal is taken, as will be shown later, to correctly adjust an equatorial mounting of this and other types.

The length of time that the star can be observed near the meridian without reversing the telescope of a German mounting depends upon the star's altitude and the amount of clearance between the eye end of the telescope and the pillar. All mountings should be constructed to allow at least one hour's run beyond the meridian for any declination of the telescope. Then, if the star is less than one hour from the meridian, it can be observed with the telescope on either the East or the West side of the pillar.

The English Equatorial Mounting. With this type, the two ends of the polar axis are supported on pillars or piers, see Pl. I., fig. 3. This enables a star to be observed from its rising to its setting, without the observer having to reverse the telescope when near the meridian. The advantages of the German type over the English are : it is more portable ; it requires only one pillar or pier, and the house or observatory for it does not require to be so large as for a similar size of telescope on an English type of mounting. Altogether, it is less costly to make and house.

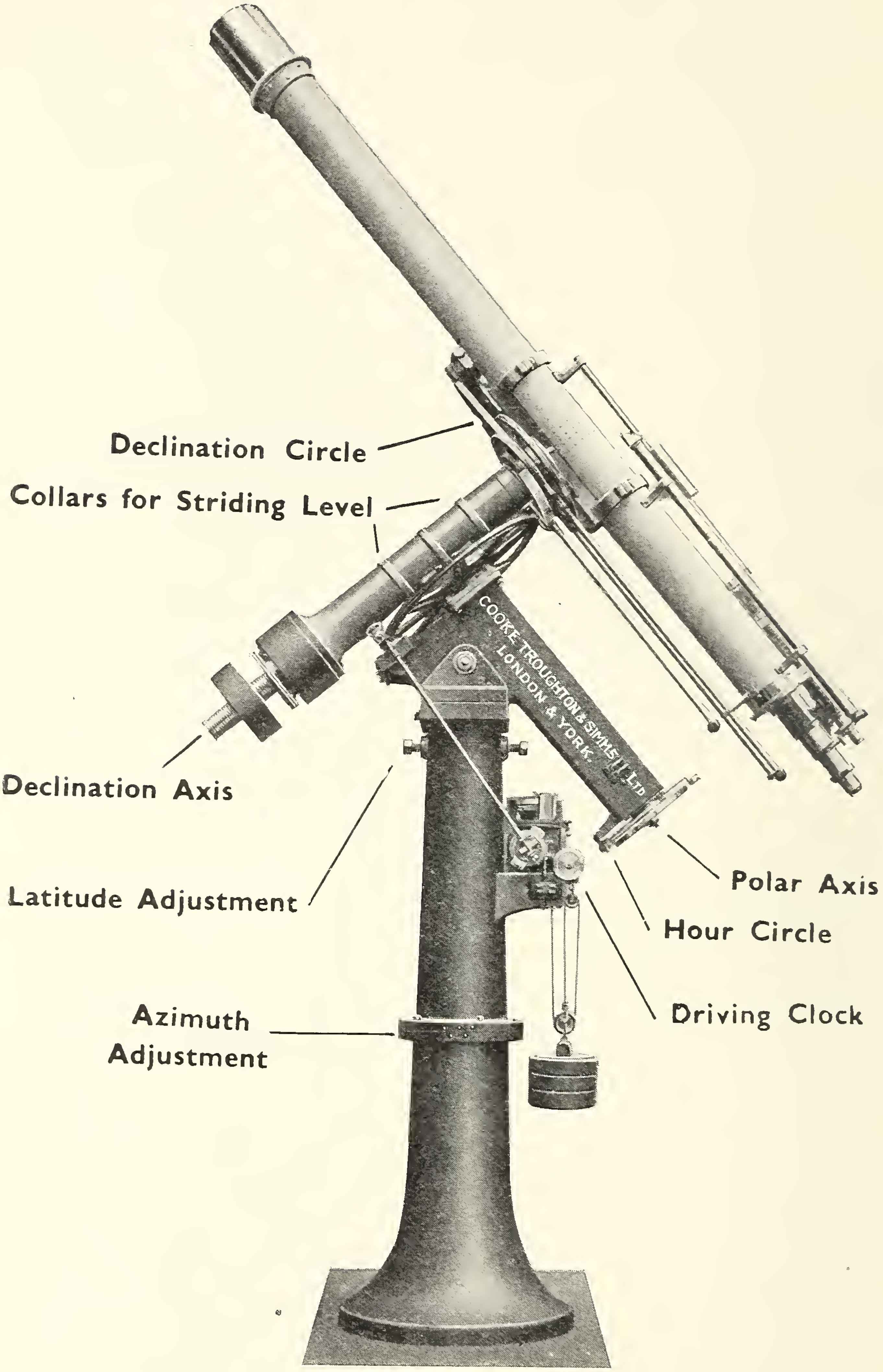

Figure 2.
EQUATORIAL MOUNTING. GERMAN OR FRAUNHOFER TYPE.

The chief disadvantage of the German type is the need for reversal when observing a star near the meridian. This is especially so when a telescope is intended to be used for photography with long exposures, as it is desirable that the duration of exposure should be equally divided on each side of the meridian.

The chief advantage of the English type over the German is its use for celestial photography, especially when carrying large cameras and telescopes.

THE ASTROGRAPHIC EQUATORIAL MOUNTING. For some years there has been a demand for a mounting to carry the short focus cameras that are found most advantageous for celestial photography, and which will combine the advantages of the German and English types without their disadvantages.

The astrographic type of mounting shown in Pl. II., fig. 4 has been designed to meet this demand. It has a massive pillar with a specially wide base, the upper part of which is set at an angle to agree with the latitude of the observatory. This upper part carries the polar axis. The upper end of the polar axis carries the declination axis, on one end of which the cameras and guiding telescope are carried. By making the upper part of the pillar longer than the cameras, etc., the cameras and guiding telescope will be found to clear the pillar in all positions, and exposures can be given from the rising to the setting of a star without having to reverse the cameras and guiding telescope.

THE LATITUDE AND LONGITUDE OF THE OBSERVATORY.

Before commencing to erect a mounting, it will facilitate the adjustment if the latitude and longitude are known, also if there is a North and South line drawn or set out on the observatory floor. When it is required to define the position of any place on the Earth's surface, its latitude is stated as so many degrees, minutes, and seconds, North or South, and its longitude as so many degrees, minutes, and seconds, East or West of Greenwich. In order to define the position of a heavenly body, it is necessary to state its declination as so many degrees, minutes and seconds of arc North or South, and its right ascension as so many hours, minutes, and seconds of time.

Terrestrial latitude is the angular distance in degrees of any point on the Earth's surface North or South of the Equator, the equator being zero.

Celestial latitude, always spoken of as declination, is the angular measure in degrees of a heavenly body North or South of the celestial equator, measured on a great circle passing through the pole and the celestial body, the equator in this case also being zero, and being in the same plane as the terrestrial equator.

Terrestrial longitude is the angular distance in degrees of any point on the Earth's surface East or West of a meridian, usually that of Greenwich.

Celestial longitude, always spoken of as right ascension, (R.A.) is the angular distance in hours of a heavenly body measured eastward along the celestial equator from the "First Point of Aries" to the hour circle on which the object lies. The 360 degrees of celestial longitude is always given as 24 hours of right ascension.

For example, the Observatory in the Yorkshire Philosophical Society's grounds at York is stated as being situated :

Latitude. 53 degrees 57 minutes 40 seconds North.

Longitude. 1 degree 5 minutes 12 seconds West.

Whilst the mean place for Alpha Lyræ (Vega) for January 1st, 1933, is defined as :—

Right Ascension. 18 hours 34 minutes 40.121 seconds.

Declination. 38 degrees 43 minutes 13.07 seconds North.

It may be interesting to note that when the declination of a celestial body is the same as the latitude of an observatory, and the celestial body is on the meridian of the observatory, it will be exactly overhead, or in the Zenith.

The following tables may be of interest :

Angles of Arc.	Angles of Time.
60 seconds = 1 minute.	60 seconds = 1 minute.
60 minutes = 1 degree.	60 minutes = 1 hour.
360 degrees = circle.	24 hours = circle.

Angles of Arc.		Angles of Time.		
360 degrees	=	24 hours	0 minutes	0 seconds.
1 ,,	=	0 ,,	4 ,,	0 ,,
15 minutes	=	0 ,,	1 ,,	0 ,,
1 ,,	=	0 ,,	0 ,,	4 ,,
15 seconds	=	0 ,,	0 ,,	1 ,,
1 ,,	=	0 ,,	0 ,,	0.067 seconds.

Angles of Time.		Angles of Arc.		
24 hours	=	360 degrees	0 minutes	0 seconds.
1 ,,	=	15 ,,	0 ,,	0 ,,
4 minutes	=	1 ,,	0 ,,	0 ,,
1 ,,	=	0 ,,	15 ,,	0 ,,
4 seconds	=	0 ,,	1 ,,	0 ,,
1 ,,	=	0 ,,	0 ,,	15 ,,

THE OBSERVATORY.

From the ordnance survey maps, on a scale of one inch to the mile, the position of the observatory can be determined for both latitude and longitude to 30 seconds of arc.

For places other than Great Britain, the latitude and longitude may be found from a good atlas, though probably not with the accuracy of the one-inch maps.

Most countries have their ordnance survey offices, and the Directors of these are always willing to give assistance. The situation of the observatory for which the first example for adjusting the telescope is given, was found from the ordnance map to be situated in :

Latitude. 54 degrees 16 minutes 30 seconds North.

Longitude. 1 degree 15 minutes 0 seconds West.

For the determining of the celestial observations, the longitude is always converted into time, thus : 1 deg. 15 mins. 0 secs.=0 hrs. 5 mins. 0 secs. The latitude and longitude of the observatory being known, we proceed to set out or define a North and South line.

SETTING A NORTH AND SOUTH LINE BY THE AID OF THE SUN.

The Equation of Time. Owing to the Sun rarely transiting the meridian of Greenwich at 12 hours noon G.M.T., being sometimes nearly 16 minutes early and sometimes nearly 17 minutes after 12 hours noon G.M.T., it is necessary to know at what time the Sun is on the meridian of Greenwich, and these daily variations are given in the Nautical Almanac and Whitaker's Almanac, and stated there as the equation of time or correction.

The Nautical Almanac tabulates the correction to be applied to mean time to give apparent time.

Whitaker's Almanac tabulates the correction to be applied to apparent time to give mean time.

For January 23rd, 1933, the equation of time given in the Nautical Almanac is—11 mins. 48.14 secs., and the hourly variation—0.661 secs. Therefore, the equation of time for January 23rd at noon will be—(0.661 secs. × 12) added to—11 mins. 48.14, secs. which equals—11 mins. 56.07 secs.

The sign in the Nautical Almanac being—(minus), the apparent time is behind the G.M.T., thus, when the G.M.T. clock shows 12 hrs. 0 mins. 0 secs. at noon on January 23rd, 1933, the Sun from which we get apparent time is 11 mins. 56.07 secs. slow, and when the Sun is on the meridian at Greenwich on January 23rd, 1933, the Greenwich Mean Time clock will show 12 hrs. 11 mins. 56.07 secs.

The following example shows the G.M.T. at which the Sun will transit the meridian of the proposed observatory on February 7th, 1933.

The equation of time for this date will have been obtained by the method described above.

12 hrs.	0 mins.	0 secs.	Greenwich Mean Time.
0 ,,	14 ,,	16 ,,	Equation of Time.
0 ,,	5 ,,	0 ,,	West of Greenwich.
12 ,,	19 ,,	16 ,,	

Thus the Sun will transit the meridian and be due South for all places of longitude 1 deg. 15 mins. 0 secs. West on February 7th, 1933, at 12 hrs. 19 mins. 16 secs. G.M.T.

If the place of observation is situated East of Greenwich, the time equivalent of the longitude is subtracted instead of being added as in the above example.

In order to obtain the best results, it will be necessary to have a good watch or clock, and to-day with the Wireless time signals, the time can be easily checked to one second of time. To determine the North and South line, take a pole eight or ten feet in height—an old flag staff will do—and set it up vertically. This can be checked by hanging a plumb bob from it in two places, 90 degrees apart. A few minutes before the calculated time of the Sun's transit, watch the shadow of the pole, and at the instant that the Sun is due South, drive a peg into the ground at the end of the shadow. A line from the pole to the peg will be a true North and South line.

SETTING A NORTH AND SOUTH LINE BY THE AID OF "POLARIS."

Another method is by sighting on "Polaris"; by this method the maximum error need not exceed 1 deg. 50 mins. When the Local Sidereal Time and the R.A. of Polaris agree, "Polaris" will be due North, and by taking a sight at this instant a North and South line may be obtained with very little, if any, error.

SETTING A NORTH AND SOUTH LINE BY A PRISMATIC COMPASS.

A third method depends on a prismatic compass which is set up on the South side of the Observatory. On raising the sights, the needle will be free to rotate. Owing to the magnetic variation, the needle will not generally point due North and South, and this must be allowed for.

The one-inch Ordnance maps for Great Britain give the magnetic variation, but it must be borne in mind that the variation is not constant. The magnetic variation for Yorkshire in 1933 is about 13 degrees 15 minutes West; thus on looking through the sights towards the North, the North end of the needle must read 13 degrees 15 minutes to the West when the line of sight through the compass sights will be due North and South.

The methods given above are very simple, and with the exception of the prismatic compass do not require any instruments, though with care quite a satisfactory North and South line may be determined. If the builder of the observatory has a theodolite, he can determine a North and South line with great accuracy by several methods.

ADJUSTING THE MOUNTING.

The mounting, with the telescope having been erected, is now ready to be adjusted. It is assumed that advantage has been taken of the North and South line set out in the observatory, and that the polar axis is in the plane of, or parallel to this line, the upper end pointing towards the North. If the polar axis is much out of the meridian, it will be very difficult to proceed with adjustments 1 and 2, because the reading of the declination circle will vary every few minutes, and it is for this reason that the correct North and South line is of great assistance.

THE STELLAR METHOD OF ADJUSTMENT OF THE MOUNTING.

To adjust a mounting correctly, it is essential to locate the centre of the field of view by means of adjustable cross wires, preferably by means of a parallel web micrometer, see Pl. III., fig. 5, using an eyepiece with a power of about 50, in order to get a fairly large field of view, and the webs should be in correct adjustment.

In order to test the micrometer, set the telescope on a star near the equator, and rotate it until the star travels in right ascension along the movable webs; now rotate the micrometer through 180 degrees, and if the star is on the webs the micrometer is correctly adjusted; if not, move the webs by the micrometer screws half the distance, and for the other half move the telescope on the declination axis. Repeat the above two or three times until the webs remain exactly in the centre; this is very important if a correct reading in declination is required.

Should a transit eyepiece be used, test and correct if necessary in a similar manner to the micrometer.

It will be of great assistance when adjusting a mounting to have a clock showing the local sidereal time; failing this, a watch regulated to keep sidereal time will serve.

The Observatory being in this instance situated 5 minutes of time West of Greenwich, this must be allowed for.

Six adjustments are necessary for an equatorially mounted telescope for correct observation.

1. The index of the declination circle must point to 0 degrees when the optical axis of the telescope points to the equator.
2. The polar axis must be set to the altitude of the pole.
3. The polar axis must be set in the meridian.
4. The polar and declination axes must be at right angles to each other.
5. The index of the hour circle must point to 0 hours when the telescope is in the meridian, that is when the declination axis is horizontal.
6. The optical axis or line of collimation of the telescope must be at right angles to the declination axis.

It is important that these adjustments should be made in the order given.

ADJUSTMENT No. 1.—The date being February 8th, 1933, for this example the stars will become visible about 5 hours 30 mins. P.M., G.M.T., or local sidereal time (L.S.T.) 2 hrs. 38 mins. 28 secs.

Select a star from the Nautical Almanac with R.A. of about 3 hrs. 0 mins. 0 secs., and with declination approaching zero, this being an easy position for observing with the telescope.

The star chosen is, we will suppose, Alpha Ceti, with R.A. 2 hrs. 58 mins. 47 secs., its hour angle being 36 minutes east of the meridian.

Bring the telescope to the west side of the pillar and point it on the star, care being taken that the star is bisected by the webs of the micrometer. Read the declination (Dec.) circle which is, say, 4 deg. 30 mins. and make a note of this and subsequent readings. Now take the telescope to the east side, again point it on the star, and again read the Dec. circle, which this time registers 4 deg. 55 mins. The mean of the two readings is 4 deg. 42 mins. 30 secs. With the star in the centre of the field, it is necessary to make the Dec. circle read 4 deg. 42 mins. 30 secs.

On large mountings, screws are provided for this purpose, and on small mountings, the circle can be slightly released on its fitting ; there is generally a screw head projecting, which can be gently tapped to bring about the desired reading.

Repeat the above until the Dec. circle reads the same with the telescope on either side of the pillar.

ADJUSTMENT No. 2.—Now the declination of Alpha Ceti is 3 deg. 49 mins. 45 secs. N., but the Dec. circle is reading 4 deg. 42 mins. 30 secs. from which it follows that the lower end of the polar axis requires to be raised 0 deg. 53 mins. 16 secs., but there is still atmospheric refraction to be allowed for, and if we can avoid this, so much the better. Therefore, look for a star near the meridian, and also near the Zenith, and Alpha Persei will do ; by choosing a star for this purpose near the Zenith, there is little or no refraction to be allowed for.

Set the Dec. circle to Alpha Persei's declination, which is 49 deg. 37 mins. 48 secs. N., and on looking through the telescope Alpha Persei is probably not in the field of view, therefore the lower end of polar axis requires to be raised by means of the screws provided for the purpose until Alpha Persei is in the centre of the field of view.

Check these readings with the telescope on both sides of the pillar, and when the Dec. circle reads 49 deg. 37 mins. 48 secs., adjustments 1 and 2 will have been made, for it is only when the index of the Dec. circle is set correctly, and the polar axis placed at the altitude of the pole, that the Dec. circle will give the correct readings with the telescope on either side of the pillar.

ADJUSTMENT No. 3.—This adjustment is made as follows in the case of large mountings of the German type :—

The pillar is made in two parts, connected together by flanges and bolts. The lower portion is firmly fixed on a masonry foundation, whilst the upper portion can be rotated through 10 degrees relatively to the lower portion as the bolt heads fit into a T groove machined in the lower flange. By this means, a convenient adjustment can be obtained for bringing the polar axis to the meridian. Two studs project, one from each flange, and by placing a bar between them, the upper part can be levered round into its proper position. This method may seem rather crude, but the adjustment has only to be made once, and no difficulty is found in securing the necessary accuracy.

The pillar for small mountings is in one casting, and the head carrying the mounting is secured to the pillar by two bolts. The clearance holes in the head are elongated so as to provide about six degrees of movement in azimuth, and by releasing the bolts and gently tapping the mounting, it can be easily rotated to the correct position.

Owing to the limited nature of the azimuth adjustment in the case of the English and Astrographic mountings, the base carrying the adjusting screws must be erected as nearly as possible in the correct position, hence the need for an accurate North and South line.

Adjustments 1 and 2 will have taken about one hour, so the local sidereal time will now be. say. 3 hrs. 40 mins. 0 secs. Look in the Nautical Almanac for a star placed about midway between the horizon and the pole, and six hours East or West of the meridian ; Theta Ursae Majoris, whose R.A. is 9 hrs. 28 mins. 26 secs., and declination 51 deg. 58 mins. 57 secs. N., is a suitable star.

In this example, refraction is ignored, but to those who wish for this refinement they will find all the formulae in Loomis' " Practical Astronomy," and with the alternative method given for this adjustment, refraction does not affect the result. Set the Dec. circle to 51 deg. 58 mins. 57 secs. and clamp the telescope in declination ; now search for this star by turning the telescope on the polar axis, and if it is not in the field of view move the mounting in azimuth until it is in the centre of the field. Another star suitable on the west side of the telescope is Alpha Cephei, whose R.A. is 21 hrs. 16 mins. 55 secs., and declination 62 deg. 18 mins. 2 secs. N. By observing these two stars, the polar axis can be set in the meridian.

This adjustment can be made in another way, but it depends on adjustments 5 and 6 having been completed, and the observer must also have the correct L.S.T. Set the declination axis horizontal by the striding level, and look for a star near the equator and coming to the meridian. In this example of the adjustment of a mounting, there is no star suitable for 1 hour 30 minutes, when there will be a number of suitable stars very quickly.

Taking Beta Orionis, whose R.A. is 5 hrs. 11 mins. 20 secs. and declination 8 deg. 16 mins. 38 secs. S., set the telescope a few minutes before 5 hrs. 11 mins. 20 secs., and if the observer knows the correct L.S.T., and the polar axis is in the meridian, the star will be on the central web at exactly 5 hrs. 11 mins. 20 secs.; but let us suppose that the lower end of the polar axis is a little to the East, then the star will be on the centre web before 5 hrs. 11 mins. 20 secs., and in this case the observer requires an assistant to keep moving the mounting in azimuth until 5 hrs. 11 mins. 20 secs., when the polar axis will be in the meridian.

Should the star come to the centre web after 5 hrs. 11 mins. 20 secs., the lower end of the polar axis is to the West of the meridian, and it must be moved towards the East, and it is better to move it just beyond the meridian and observe the next star, viz., Gama Orionis, and proceed as before. The advantage of using this method is that there is no refraction to allow for, but it assumes that the L.S.T. and adjustments 5 and 6 are correct.

ADJUSTMENTS 4 and 5.—These two adjustments can generally be taken together. Set the declination axis horizontal by placing a striding level on the two machined collars. See Pl. III., fig. 6. The striding level should be in adjustment, also one division of the bubble should preferably agree with one division of the vernier of the hour circle; thus, if the vernier is reading to two seconds of time, one division of the bubble should also represent two seconds of time. To check the adjustment of the striding level, see if the bubble remains level on reversing the striding level on the collars. If so it is correct, but if not, eliminate one-half of the error by means of the screws provided on the striding level, and the other half by rotating the polar axis.

This may require doing two or three times to get the level to reverse without showing any error on the bubble. Having adjusted the striding level to give the same reading on reversal, the declination axis is horizontal. Set the index of the vernier of the hour circle to zero. In those types of hour circles with two verniers, one reading L.S.T., the other the star's R.A., the index line of each vernier must be set exactly opposite; this completes No. 5 adjustment, but to check No. 4 adjustment turn the telescope on the polar axis through 12 hours, thus bringing the declination axis horizontal again, place the striding level on the collars, and if the declination axis is at right angles to the polar axis, the vernier of the hour circle will read zero.

Usually there are no means provided for correcting this, but the greatest care is taken during the manufacture of a mounting to see that the collars are equal in diameter, exactly concentric with the declination axis, and that the face of the flange, bolted to the polar axis, is exactly at right angles to the collars, or parallel with the declination axis. This is looked upon as a mechanical adjustment which is made before a mounting leaves the workshop.

ADJUSTMENT No. 6.—To make this adjustment, a star near the equator and the meridian is selected, and Alpha Orionis is suitable, as the R.A. is 5 hrs. 51 mins. 34 secs. With the telescope on the West side, set the declination circle to the declination of Alpha Orionis, which is 7 deg. 23 mins. 51 secs. N., and the R.A. vernier of the hour circle to 5 hrs. 51 mins. 34 secs., this being the R.A. of Alpha Orionis, and the L.S.T. vernier to read, say, 5 hrs. 47 mins. 0 secs., and if the optical axis is at right angles to the declination axis, the star should be on the centre web of the micrometer or transit eye piece, at 5 hrs. 47 mins. 0 secs., by the sidereal clock. Let us suppose that the star was on the centre web at 5 hrs. 46 mins. 58 secs., or two seconds early. Now reverse the telescope, taking it to the East side of the pillar and set again to Alpha Orionis's declination, and the L.S.T. vernier to 5 hrs. 50 mins. 0 secs., and with the sidereal clock note again the exact instant that the star is on the centre web, and suppose it is 5 hrs. 50 mins. 2 secs., or two seconds too late, there being a difference of two seconds in each case. This proves that the optical axis is not at right angles, as in the first instance the telescope pointed two seconds too soon, and in the second instance two seconds too late.

In the case of large telescopes with built-up tubes on a cast iron centre piece, no means are provided for this adjustment, but the greatest care is taken in manufacture to see that the flanges of the centre piece and of the telescope tubes are at right angles to the optical axis.

With small telescopes, the tube is in one piece, and a cradle is fixed to the declination axis : on the cradle are two clasps holding the telescope tube. To correct for the error, it will be necessary to release the screws of the clasp nearest to the object glass and insert a thin sheet of paper between the tube and clasp, for the error shows that the object glass end of the telescope tube is less than a right angle to the declination axis. It may require two or three observations before the correct thickness of paper may be determined.

Some observers having determined this error do not correct the instrument, but allow for it as a constant for all observations. The mounting should now be in good adjustment. In the example given, the mounting having been fitted with accurately divided circles, it was possible to adjust it within very close limits.

ALTERNATIVE STELLAR METHOD.

The following method is useful for those mountings which are not fitted with circles or are fitted with very coarsely divided ones, *but have good driving clocks correctly rated.*

To set the polar axis to the altitude of the pole for adjustment No 2.

The latitude of the observatory having been determined from the Ordnance Survey maps, this will give the angle that the polar axis must be set to, see Pl. IV., fig. 7.

In the shop, an inclinometer or clinometer is used, see Pl. IV., fig. 8, to set the polar axis to the correct altitude. Pl. III., fig. 6, and Pl. IV., figs. 7 and 8 show a small equatorial mounting, with driving clock, but without the pillar or telescope. Where a clinometer is not available, take a protractor of 6 or 8 inches diameter, and mark on a piece of hard wood about an inch thick the correct angle, see Pl. IV., fig. 7. Cut the wood to this angle and hold it on the face of the driving circle, or any other convenient surface parallel with it. Place a good spirit level on the top edge of the wood block, and by means of the latitude adjustment screws, bring the air-space of the spirit level to the centre of its run. The polar axis will now be fairly accurately set to the altitude of the pole.

To set the mounting in the meridian for adjustment No. 3, the polar axis must be set as near parallel as possible with the North and South line that has been drawn on the floor of the observatory.

Having done this, set the telescope on " Polaris " or any star near the pole, and if the mounting is in perfect adjustment the driving clock will keep the star on the centre of the cross formed by the webs of the micrometer or transit eyepiece, but if not, it can be out either in azimuth or altitude, or a combination of both.

To observe or determine when the star is exactly bisected by the webs, the star should be a little out of focus, so that the diffraction disc is seen. When the star is exactly in focus, it appears as a point of light, but when slightly out of focus a disc of light is seen, and it is much easier to determine when the disc is exactly bisected by the webs, than it is with a point of light. A little experience is required to determine how much the star should be out of focus.

Observe the star for 10 to 15 minutes ; if it remains central on the webs, the mounting is in correct adjustment.

If the star trails up, the axis points West of the pole.

If the star trails down, the axis points East of the pole.

If the star trails to right, the axis points above the pole.

If the star trails to left, the axis points below the pole.

Should the star trail diagonally, which is possible, the mounting is out of adjustment in both azimuth and altitude.

This method requires some time, but if done carefully and notes made each time that the mounting is moved or set, it can be brought into very accurate adjustment.

During the Autumn of 1931, an astrographic mounting, see Pl. II., fig. 4, was erected at the Norman Lockyer Observatory, Sidmouth. This mounting had very coarsely divided circles, the declination circle was divided to single degrees and read by a single index, and by estimation to about 15 minutes of arc. The hour circle was divided to 5 minutes of time and read by a single index, and by estimation to about one minute of time.

The mounting was adjusted as nearly as possible by these circles, but for photographic purposes where exposures of 6 hours and upwards were required, it was found that the mounting was not adjusted with the necessary accuracy.

To get the mounting correct, Dr. William J. S. Lockyer adopted the method just described. The star taken for this example was " Polaris," using the " out of focus image " or " diffraction disc," which was centred exactly on the cross formed by the webs of the transit eyepiece. The illumination used gave bright webs on a dark field.

NOVEMBER 28th, 1931

No. 1.

8 hrs. 47 mins. Set central on the webs.
8 hrs. 57 mins. Star trailed DOWN.
Star trailed RIGHT.

Turned azimuth screw 90 degrees or quarter revolution, moving the North end of polar axis to the West.

Turned the altitude screw 90 degrees or quarter revolution, so that the North end of polar axis was lowered, then reset the telescope on the star.

No. 2.

9 hrs. 2 mins. The star central on the webs.
9 hrs. 12 mins. Star trailed DOWN.
Star trailed RIGHT a little.

Turned azimuth screw 90 degrees, moving the North end of polar axis to the West.

Turned the altitude screw 30 degrees so that the North end of polar axis was lowered, then reset the telescope on the star.

No. 3.

9 hrs. 16 mins. The star central on the webs.
9 hrs. 26 mins. Star trailed DOWN.
No RIGHT or LEFT trail.

Turned azimuth screw 90 degrees, moving the North end of polar axis to the West.

Did not move the altitude screw, then reset the telescope on the star.

No. 4.

9 hrs. 30 mins. The star central on the webs.
9 hrs. 45 mins. Star trailed DOWN
No RIGHT or LEFT trail.

Turned the azimuth screw 90 degrees, moving the North end of polar axis to the West.

Did not move the altitude screw, then reset the telescope on the star.

No. 5.

9 hrs. 47 mins. The star central on the webs.
10 hrs. 7 mins. Star trailed DOWN a little.
No RIGHT or LEFT trail.

Turned the azimuth screw 30 degrees, moving the North end of polar axis to the West.

Did not move the altitude screw.

DECEMBER 4th, 1931.

8 hrs. 18 mins. Set " Polaris " central on the webs.
8 hrs. 55 mins. Star STATIONARY UP AND DOWN.
Star trailed to the RIGHT a little.

Did not move azimuth screw.

Turned the altitude screw 15 degrees so that the North end of the polar axis was lowered, then reset the telescope on the star.

8 hrs. 56 mins. The star central on the webs.

9 hrs. 56 mins. NO CHANGE EITHER WAY, showing that the mounting was correctly adjusted, and this has been proved by the taking of photographs with an exposure of 4 hours which do not show the slightest sign of trail, the stars showing good round images.

It will be seen from the instructions given that the telescope has been adjusted by the stars, but there are times when it will be of great assistance if the telescope can be adjusted mechanically.

ADJUSTMENT WITHOUT REFERENCE TO CELESTIAL OBJECTS.

The method about to be described, while not quite so accurate as the method of adjustment by the stars, can be done in the daytime, and at night if it should be clear, there will only be adjustment No. 3 to make, and Nos. 1, 2, 5, 6 to check.

With this method, advantage is taken of the fact that when the mounting is correctly adjusted and the telescope is pointing to the Zenith, the hour circle reads zero, and the declination circle reads the latitude of the observatory.

Before commencing to adjust the telescope, release the clamping ring of the declination circle and turn the circle on its fitting, so that when the telescope is pointing to the pole the circle is reading approximately 90 degrees.

To adjust, remove the object glass from the telescope and put on the dewshade and cap. In the centre of the cap drill a small hole to pass a cord for a plummet. From this hole suspend a cord through the interior of the telescope, passing out at the eye end through the eyepiece fitting, and hang on the cord a weight of about one pound, thus making a temporary plummet. Now point the telescope to the Zenith, and when there the cord will be in the centre of the eyepiece ; to get a little more accuracy, remove the lenses from the low power eyepiece, place this in the eyepiece fitting, and pass the cord through the cover of the eye lens, the hole of this will be about 0.25 of an inch diameter ; this will enable one to judge when the cord is in the centre of the eyepiece fitting with greater accuracy.

Having set the telescope on the East side of the pillar pointing to the Zenith with the plummet cord in the centre of the hole, set the hour circle to read zero. If the declination circle has not been set accurately to read the latitude of the observatory, turn the declination circle on its fitting to read 54 deg. 16 mins. 30 secs., exactly, this being the latitude of the observatory, and tighten up the clamping ring.

Having made the declination circle read 54 deg. 16 mins. 30 secs., reverse the telescope to the West side of the pillar, and again point to the Zenith with the plummet cord in the centre of the hole, read the hour circle and, if it reads zero, adjustments Nos. 5 and 6 are correct.

If the telescope is a large one, and there is an error, nothing can be done except to halve the error on the hour circle, and apply this error as a constant. If a small telescope and there is an error, it can be corrected in the manner already set out for adjustment No. 6.

Suppose the declination circle reads 53 deg. 16 mins. 30 secs., the error being one degree, set the circle until it reads the mean, viz., 53 deg. 46 mins. 30 secs., reverse the telescope to the East side as before, and read the declination circle, which should give the same reading. If necessary, repeat the above until the declination circle reads the same with the telescope on either side of the pillar, when No. 1 adjustment will be correct.

Now turn the telescope on the declination axis until the declination circle reads the latitude of the observatory, viz., 54 deg. 16 mins. 30 secs. and of course now the plummet cord will not be in the centre of the hole ; to bring the cord to the centre, depress the lower end of the polar axis until the cord is in the centre, when No. 2 adjustment will be correct. Adjustments 1, 2, 5, 6 have now been made, and it only remains to secure No. 3 by observation of the stars in the manner already set out, and to check the other adjustments.

Adjustments Nos. 1, 2, 5, 6 can also be made by means of a clinometer, see Fig. 8, and this is the procedure followed by the makers.

By means of the circles of an accurately adjusted mounting, we can direct the telescope on a clear night on any celestial object that is above the horizon, also in clear weather in the daytime we can direct the telescope and observe first and second magnitude stars. To do this quickly, it is necessary to have a clock which shows the Local Sidereal Time.

Assuming that the sidereal clock is keeping the correct L.S.T., each star will come to the meridian at the time shown in the Nautical Almanac ; for example, when the sidereal clock shows 5 hrs. 51 mins. 34 secs., on February 6th, 1933, Alpha Orionis will be on the meridian, since 5 hrs. 51 mins. 34 secs. is the R.A. of Alpha Orionis.

FINDING AND OBSERVING CELESTIAL OBJECTS.

The best time for observing a celestial object is when it is near the meridian, as it is then at its greatest altitude, but for continuous observation we must also consider the declination.

Thus, in England, stars with a declination of 20 degrees South can only be observed for about 5 hours, viz., 2½ hours before coming to the meridian, and 2½ hours after passing the meridian.

Stars with zero declination can be observed for four hours on each side of the meridian, and stars with a declination of 20 degrees North and upwards, can be observed for 6 hours or more on each side of the meridian ; therefore before observing a star on any evening it is necessary to note the L.S.T. and see if its R.A. is within the range given above.

As an example, the date is Feb. 9th, 1933, L.S.T. 5 hrs. 30 mins. 0 secs. In order to set the telescope on Alpha Tauri, whose R.A. is 4 hrs. 32 mins. 5 secs., and whose declination is 16 deg. 22 mins. 43 secs. N., the telescope will have to be on the East side of the pillar since the star has passed the meridian. Set the declination circle to read 16 deg. 22 mins. 43 secs. The difference between the star's R.A. and the L.S.T. is 0 hrs. 57 mins. 55 secs., the telescope must be turned on the polar axis until the Hour Circle reads 0 hrs. 57 mins. 55 secs., West from zero, when Alpha Tauri will be in the field of view.

With the simplest type of hour circle and vernier, this calculation has to be made and allowed for ; but it is usual to fit a type of hour circle and verniers that do not require this calculation to be made. The circle has two sets of graduations and two verniers, one reading the star's R.A., the other the L.S.T. As an example, on June 20th, 1933, the L.S.T. being 16 hrs. 0 mins. 0 secs., it is required to set the telescope on Alpha Lyrae, whose R.A. is 18 hrs. 34 mins. 43 secs. This star has not yet come to the meridian, so the telescope should be on the West side. Set the declination circle to read the star's declination 38 deg. 43 mins. 5 secs., then set the R.A. vernier to read the star's R.A., viz., 18 hrs. 34 mins. 43 secs., and turn the telescope on the polar axis until the L.S.T. vernier reads the L.S.T., when the star will be in the field of view.

If an equatorially mounted telescope of good design and workmanship is erected on a solid foundation, it will maintain its adjustment almost indefinitely.

I have not referred to the adjustments or testing of the object glass of the refractor or the mirror of the reflector. These will be found fully dealt with in " The Adjustment and Testing of Telescope Objectives " by T. Cooke & Sons, Ltd.

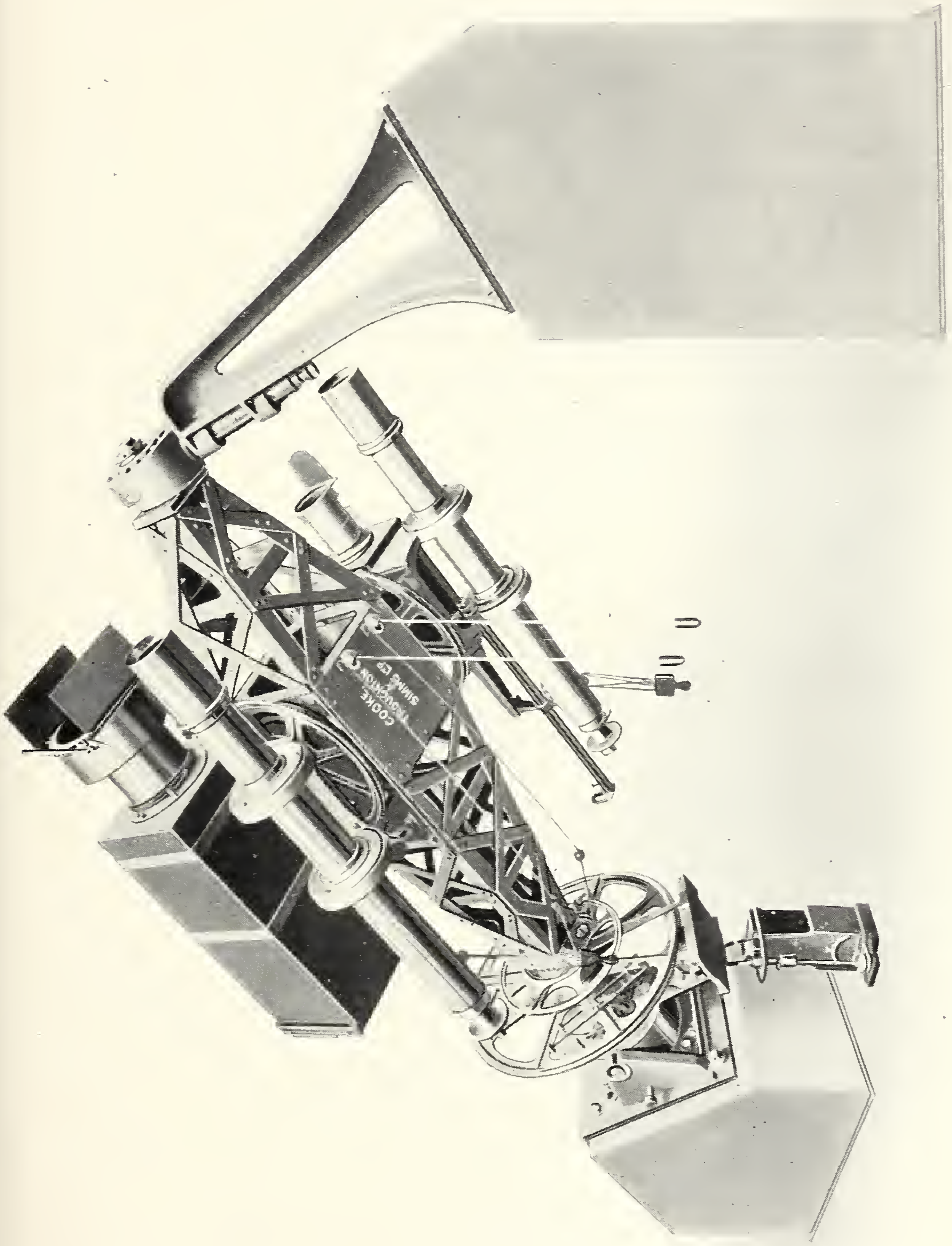

Figure 3.
EQUATORIAL MOUNTING. ENGLISH TYPE.

BRITISH MUSEUM
19 APR 33
NATURAL HISTORY.

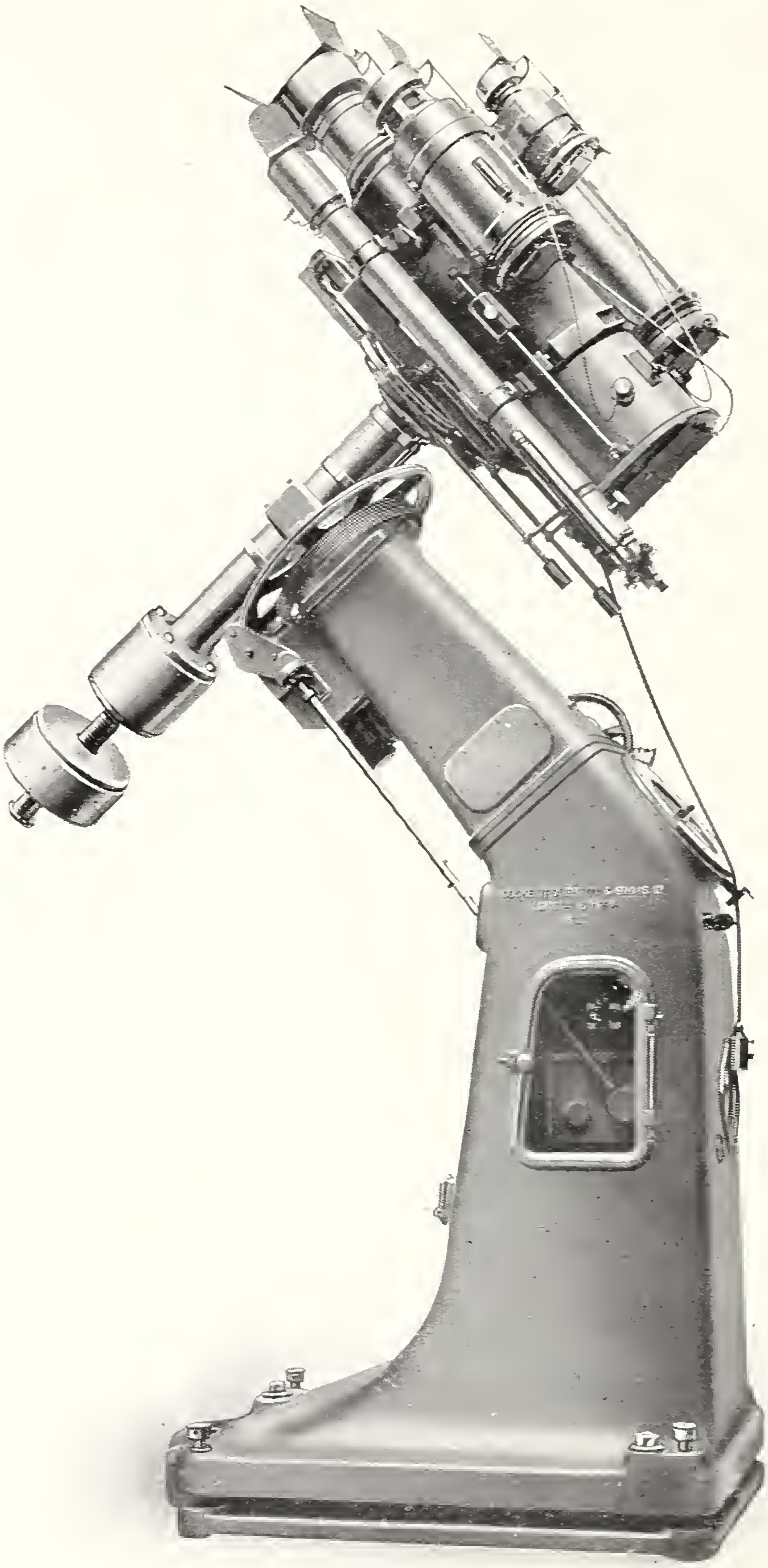

Figure 4.

EQUATORIAL MOUNTING. ASTROGRAPHIC TYPE.

Presented by Dr. Robert Mond to the Norman Lockyer Observatory, Sidmouth.

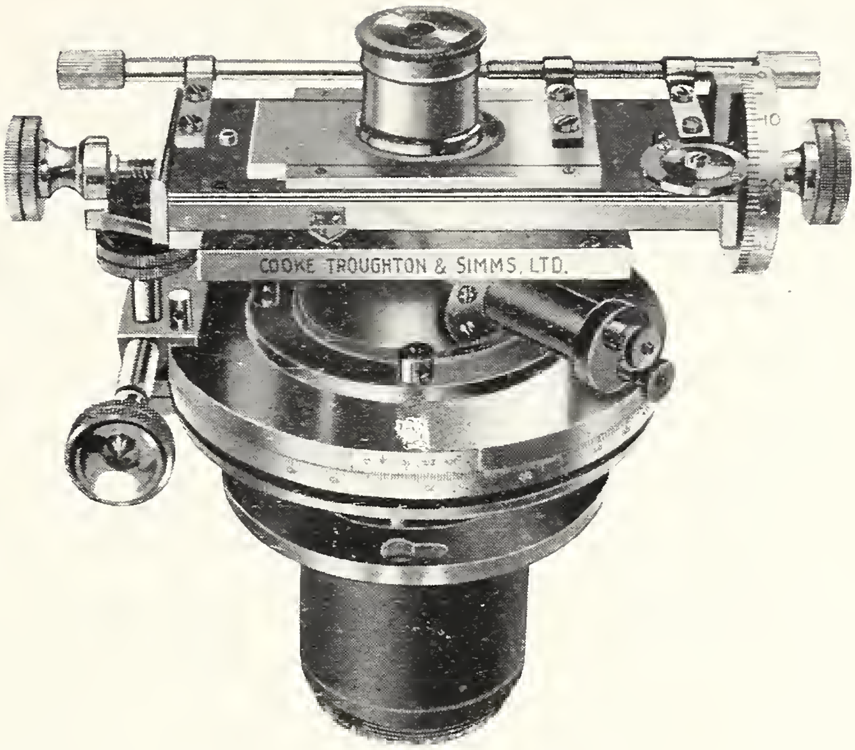

Figure 5.
PARALLEL WEB MICROMETER, WITH POSITION CIRCLE.

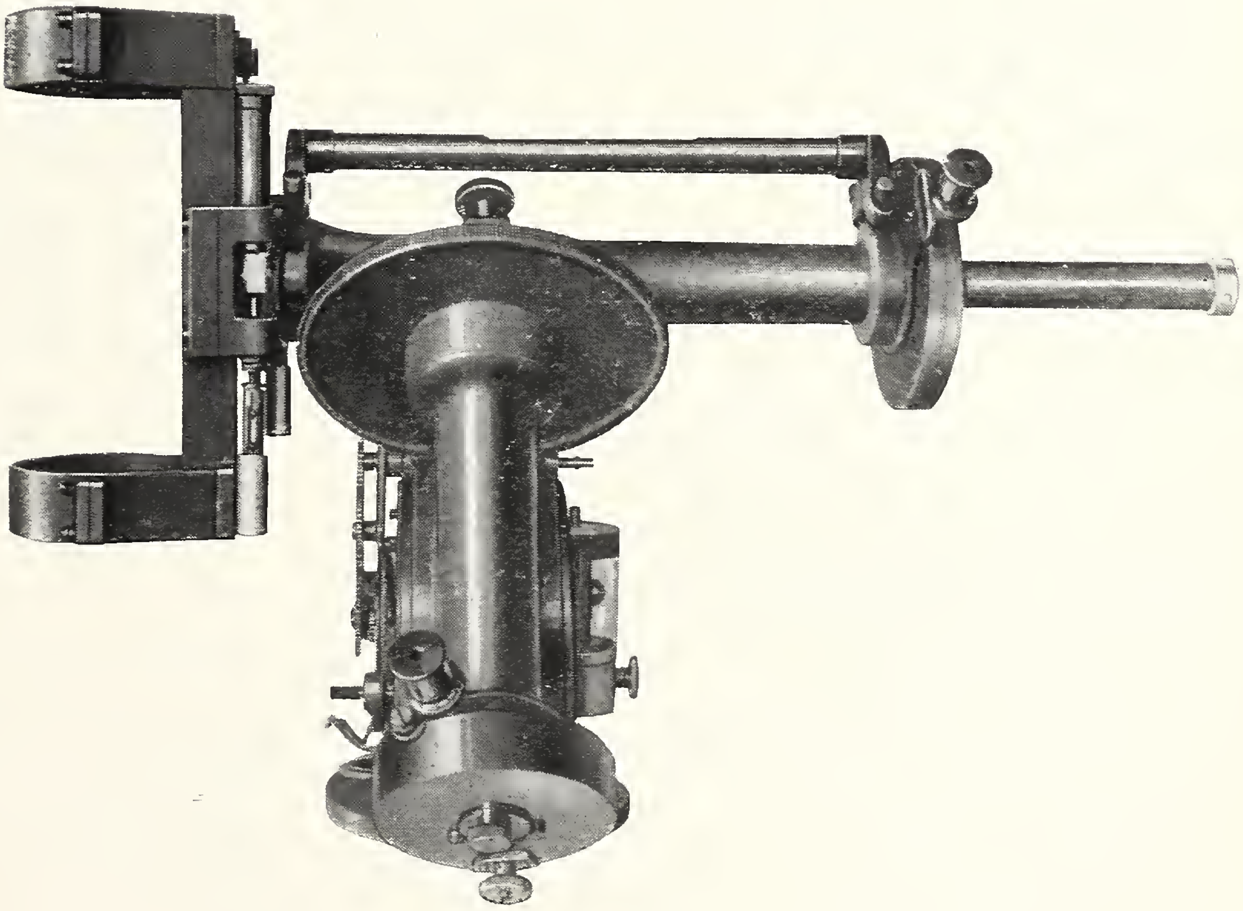

Figure 6.

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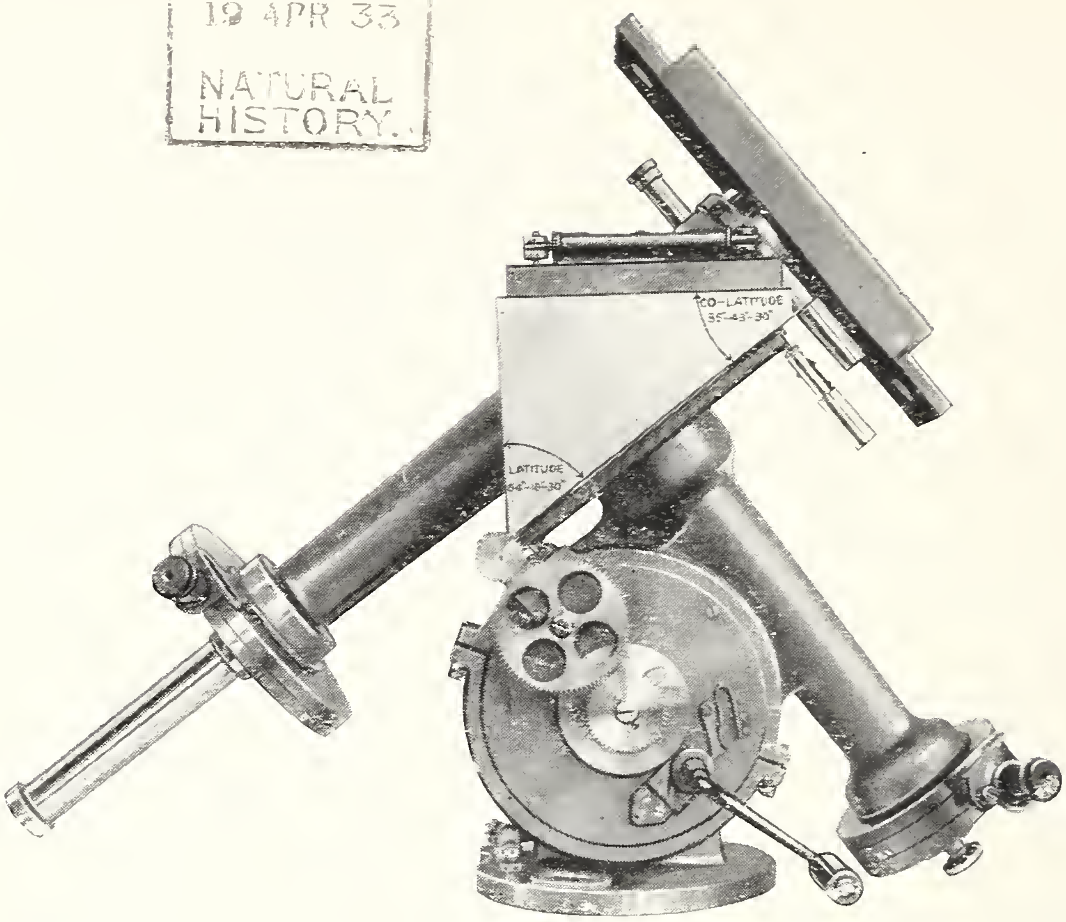


Figure 7

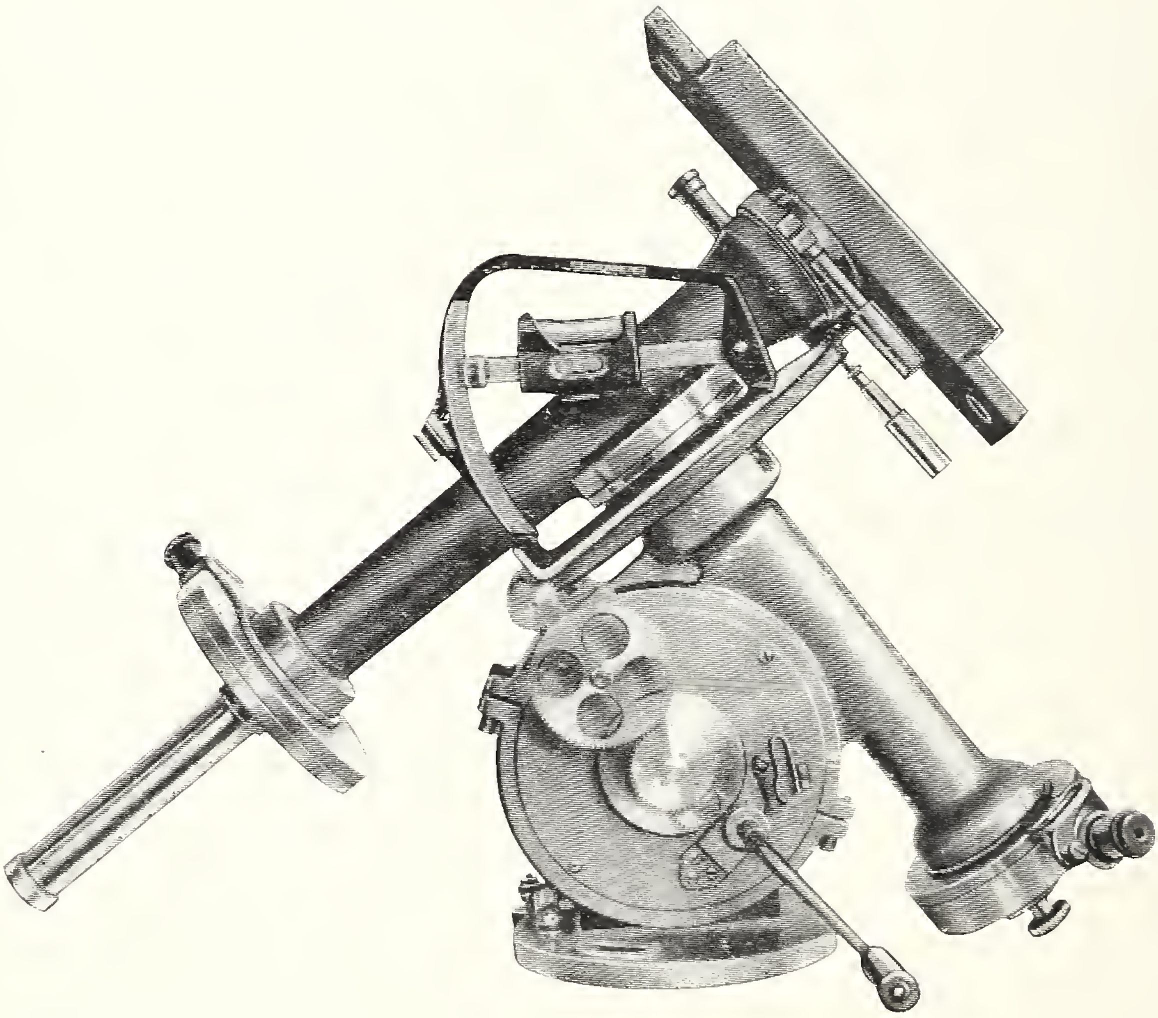


Figure 8.

A NEW SYSTEM OF DENOMINATING TYPE SPECIMENS.

By Arthur Hurst,
Hon. Curator of Ceramics, The Yorkshire Museum, York.

Now that the Specimens in our Museums are becoming of so much more value for Educational purposes, it seems fitting that we should revise our methods of classification and labelling so as to give scholars and students better means of comparing the various specimens, and of more readily perceiving the differences between them. The old method of selecting a Specimen and calling it " Type A," and another, differing slightly from it, and constituting it a Sub-type, as " Type Aa " ; or, if the differences are considerable, of making a new " Type B," does certainly divide the collection into classes, but leaves the beholder without any guide as to the exact *points* of the " Types " themselves, and the reason for their selection as " Types," or of the differences between them. Also, as few Museums possess specimens of every form from which to select " Types," the result is that " Type A " in one Museum may be " Type D " in another, which must always be a draw-back and embarrassment to any student. These facts became very evident when we recently attempted to arrange, describe and label the Green-glazed Mediaeval Pottery in the Yorkshire Museum, where the number of pieces is large, and the forms (chiefly jugs and pitchers) very varied in form, and this led to the whole question being carefully studied with a view to finding a system which would overcome these difficulties, and yet be simple and practical. This has been done, and it remains for us to describe this new system in detail.

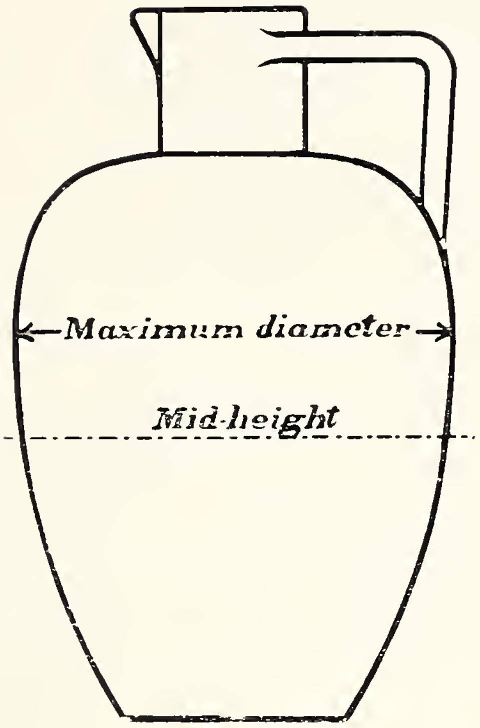
A few preliminary remarks are necessary to make quite clear what is the scope of this system. It aims at describing the body of a jug, pitcher, bowl, cup, or other *hollow* piece, even though there is no " Type " specimen to compare it with—we compare it with a simple well-known form or standard, and show where and in what way it varies from such Standard—but we exclude consideration of the handle and ornament, as they form no part of the body, being made separately and applied later, with the result that any kind of handle or ornament can be applied to any jug, even though not the most suitable form, and it was thought best therefore to describe the handle separately, either on the label or in the catalogue. The spouts of the mediaeval jugs are generally formed by pressing outwards the mouth and upper part of the neck by the thumb of the potter, and it is generally sufficient to assume that this is the form in nearly every case, and it then only becomes necessary to describe spouts of other forms.

For our Standards we searched out for the simplest form of jug which could be made, and after due consideration decided that it was one, the body of which, from the base of the neck to the base, or foot, of the jug, was *contained by a single regular convex curve,* which, when the maximum diameter of the jug is double the radius of such curve, gives a true spherical or globular form, with a portion cut off to form the flat foot, and another portion cut off to join up to the neck. But it is clear that the form of the jug may be compressed so as to be of less diameter, in which case the curve may still be the arc of a circle, but of greater radius, and if further compressed the curve will leave the simple form and become a transitional or compound curve, similar to the side of an ellipse; or, if on the other hand the form of the jug is expanded, so that the maximum diameter is greater than that of the sphere, then the curve will take the form of the end of an ellipse, so long as the maximum diameter remains at or about mid-height between the base of the neck and the foot of the jug. This Standard form we take as our "Type B."

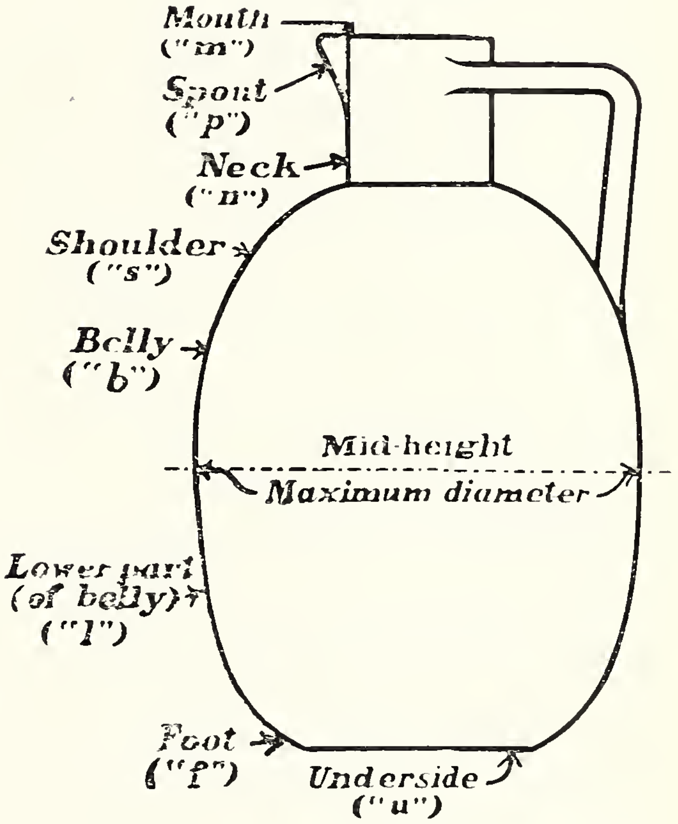
But it is possible for the maximum diameter to be considerably above this mid-height line, in which case the curve is still a continuous transitional convex one, but takes an ovoid (egg-shaped, not oval) form, with the larger end uppermost, giving the most usual form, the high-shouldered jug, and this Standard we make our "Type A." But if we put the maximum diameter considerably below the mid-height line, we again get an ovoid form of curve, with the smaller end upwards, giving the bag—or flask-shaped form of jug—and this we make our "Type C." We have only these three simple Standards which are easily recognised by the position of the maximum diameter. The sides of all are formed of continuous convex, generally transitional but sometimes simple, curves. In each case the mouth is plain and flat on the top, the neck cylindrical, and the spout, pressed out at the top by the potter's thumb. The diagram, Pl. V., figs. 1, 2, and 3, shows the three Standard Jugs.

It will be observed that on the diagram the various parts of a jug are named, in accordance with the terms used by

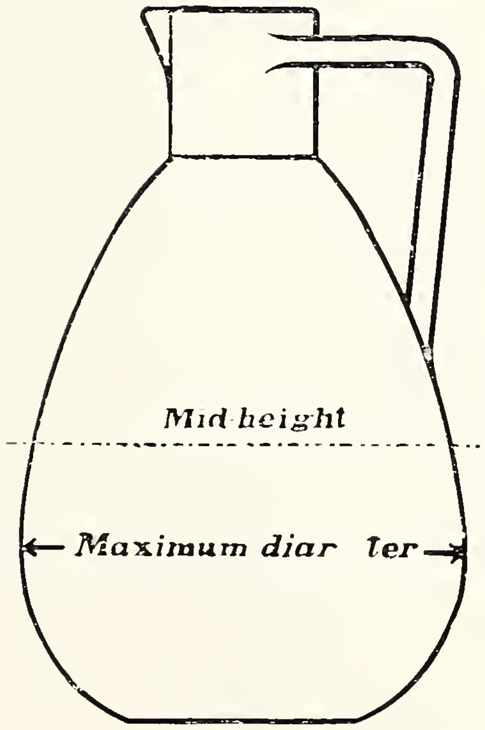
Type A.



Type B.



Type C.



The Simplest Forms of Jugs.

Figs. 1, 2 and 3.

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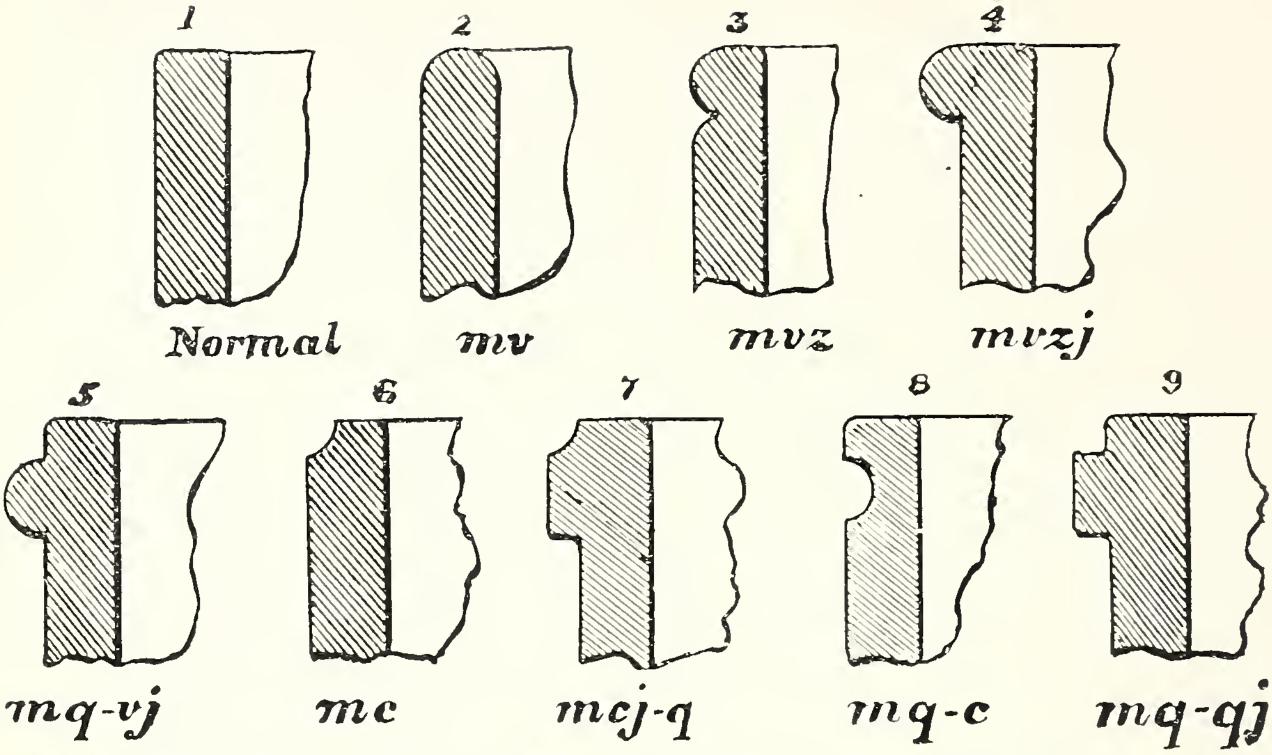
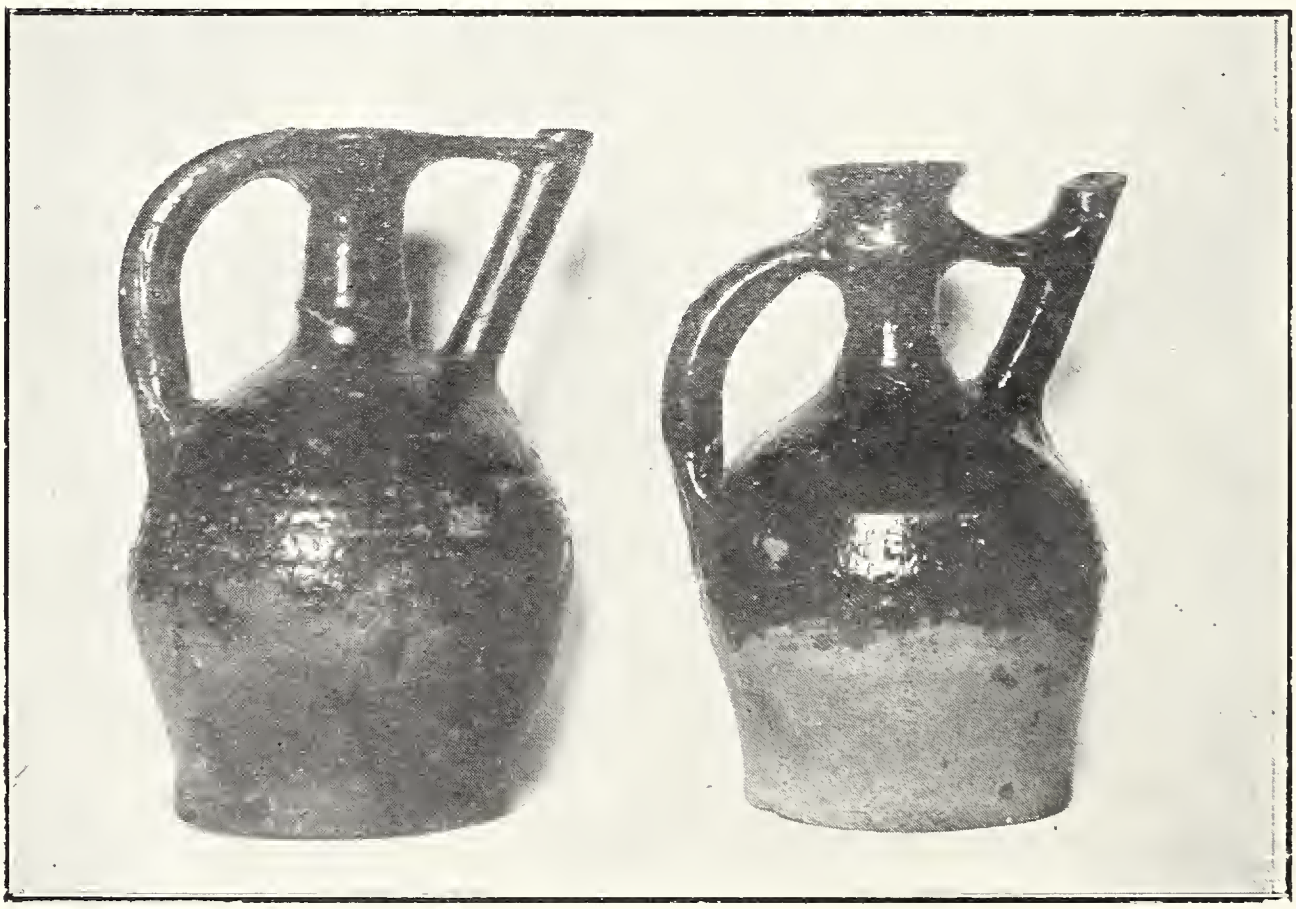
NATURAL
HISTORY.



Part Sections through various forms of Mouths.

Figs. 1–9.



SPOUTED JUGS.
Figs. 10 and 11.

potters and others, as far as possible, the initial letters of which names, we term " location " letters, and these with the " qualifying " letters, which consist of the remaining letters of the alphabet, each indicating a descriptive word, afford the means of indicating the differences between specimens. Below we give a complete list of the letters and their meanings :—

	" Locations " (Parts of Jug).	" Qualifying letters " (Descriptions).
" a "		*a*bsent, non existing, missing.
" b "	*b*elly of jug.	
" c "		con*c*ave, hollowed, hollow.
" d "		*d*iverging, conical, cone-shaped.
" e "		*e*nlarged, widened, fairly large.
" f "	*f*oot (base).	
" g "		great, large.
" h "		*h*igh, *h*eight.
" i "		*i*nverted, reversed, upside-down.
" j "		*j*utting, protruding, more prominent, stepped forward out of line.
" k "		curt (phonetic *k*urt), short.
" l "	*l*ower part (of belly).	
" m "	*m*outh.	
" n "	*n*eck.	
" o "		*o*blique, sloping, inclined, diagonal.
" p "	s*p*out (*p*ourer).	
" q "		e*q*uidistant, parallel, cylindrical.
" r "		e*r*ect, vertical.
" s "	*s*houlder.	
" t "		*t*hin, slim, narrow.
" u "	*u*nderside.	
" v "		con*v*ex.
" w "		*w*ide, *w*idth.
" x "		e*x*aggerated, very.
" y "		*y*ard, straight (as a ship's yard or spar).
" z "		hori*z*ontal.

These letters only have the meanings given above ; in every case of change from the standard form the appropriate " location " letter is used, occasionally alone, but generally followed by one or more " qualifying " letters.

When a “ location ” letter is used alone, it indicates that the *first* natural change of the part referred to is inferred. For example “ l ” would signify such a change in the lower part (of the belly) of the jug; now the normal form is convex, and the first natural change from convex must be a straight line, so there is no need to add “ y ” for the meaning is perfectly clear without it, but “ ly ” is of course quite correct. The first natural changes are :—

“ n ”	the neck has been changed from cylindrical to concave (a change to convex would also be a first natural one, but in the reverse direction to all other changes, and is accordingly ignored).
“ s ”	the shoulder has been changed from convex to straight.
“ b ”	the belly has been changed from convex to straight.
“ l ”	the lower part (of belly) has been changed from convex to straight.
“ f ”	the foot has ceased to be a mere continuation of the lower part, and has become a straight vertical line.
“ p ”	the spout has changed from the convex (on outside) to a straight line, and is therefore angular.

Combinations of each of the “ location ” letters with each of the “ qualifying ” letters are possible, but not always applicable; for the sake of example we give all the combinations of the “ qualifying ” letters with the location letter “ m,” thus we have :—

“ ma ”	mouth absent (possible).
“ mc ”	mouth concave.
“ md ”	mouth conical (possible).
“ me ”	mouth enlarged.
“ mg ”	mouth large.
“ mh ”	mouth high (inapplicable).
“ mi ”	mouth inverted (inapplicable).
“ mj ”	mouth jutting (banded).
“ mk ”	mouth short (inapplicable).
“ mo ”	mouth oblique (not straight).
“ mq ”	mouth cylindrical (hardly applicable without another letter).
“ mr ”	mouth vertical (hardly applicable without another letter).
“ mt ”	mouth small.
“ mv ”	mouth convex.
“ mw ”	mouth wide.

" my "	mouth straight (hardly applicable).
" mz "	mouth horizontal (inapplicable).

As the mouth is small, and many changes affect the upper part of the neck as well, we give sections through mouth and neck, showing several different forms, some of which frequently, and others seldom occur, but they serve to show how they, or other somewhat similar cases can be dealt with (see diagram, Pl. VI., figs. 1–9, ante).

There is no difficulty in using two qualifying letters ; for example, we may have :—

" mwe "	mouth moderately wide.
" mwx "	mouth very wide.
" mte "	mouth somewhat small.
" mtx "	mouth very small.

We now come to a series of combinations in which a hyphen occurs ; this is used as a ligature to connect two or more letters or groups of letters, showing that the form is a compound one ; that is, it really has been changed from the original simple form to a form consisting partly of one form and partly of another, thus :—

" c-v "	indicated a " concave-convex " curve, as " lc-v " which indicates that the lower part has changed from convex to concave-convex ; note the " l " is only used once so long as the " l " and " c-v " are co-extensive.
" v-c "	is of course the reverse of the above, and describes a convex-concave curve, as " bv-c " which denotes a convex-concave belly. Here there is a curious analytical fact involved, the " v " actually prevents a change taking place in the convex portion of the curve concerned, but the formula is simpler as a whole than if the change was otherwise described.
" y-v "	is, of course, a straight-convex curve, used similarly.
" b-b "	is an unusual form ; it denotes that the convex belly has been changed into two straight lines, and as they are connected together, they must be at an angle, and in such a position that they form the maximum diameter of the jug, therefore the angle must be outwards. This is in fact the form of the belly of the bi-conical jug, in which the straight shoulder is in line with the straight upper part of

the belly, and the lower part, also a straight line, is in line with the lower portion of the belly. The complete description of this class of jug being "Type B s-b-b-l." Incidentally this is one of the oldest forms of jug, fragments having been found in dwellings of the stone age (some 4,000 years B.C.) when there was no potter's wheel. They were probably made in two parts, the clay being pressed round a conical stone, and joined together at the centre. Vases are sometimes similarly made in sections by the Chinese.

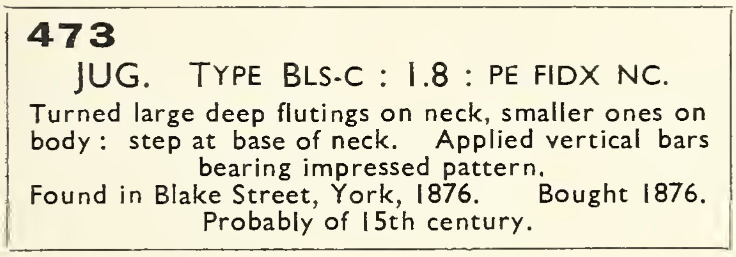
"Type pA" is also an unusual designation which was evolved to specify a peculiar form of jug, having a small neck and independent cylindrical spout rising from the shoulder (see illustration, Pl. VI., figs. 10 & 11, ante) and which we have termed "Spouted Jugs." This is the only case so far, where a letter is used before the Type letter proper.

There are some cases where unimportant beadings, flutings, steps, or grooves are best treated as ornaments, as they really form no part of the shape of the body as a whole.

There are also names indicating form, which if used on the labels greatly assist in the appreciation of a piece, such as "hexagonal," "octagonal." "oval," "flat-sided," "trefoil," "quatrefoil," "cinquefoil," etc., all of which shapes occur on mediaeval pottery. The word "pitcher" used in its old sense of a *spoutless jug* is also a useful distinguishing word. There are also "Squat" Jugs (or Gotches) with ratio about 1.1; "Stout" jugs with ratio about 1.4; "Robust" jugs with ratio about 1.5; "Normal" jugs with ratio about 1.7; "Slender" jugs with ratio about 1.8; "Slim" jugs with ratio about 2.0; and "Lanky" jugs with ratio about 2.5; and last come the old "Well-jugs" of uncertain ratio, but so well-known by their tall, thin form, and so well suited for lowering into narrow wells, and so much less apt to be broken, or to spill their contents when in use.

The ratio figures just referred to form part of our scheme for conveying an approximate idea of proportion; they represent the ratio between the maximum diameter and the height (the height in terms of the diameter), shown as a whole number and a single decimal; this is of course only approximately correct, but has been found to give a very fair idea of the form of the piece; in making the measurements, it is sometimes necessary in the case of jugs with abnormally long necks, to ignore so much of the neck as is abnormal. These ratio numbers render the names given above of less importance, but they are still found convenient, especially in the extreme sizes.

We append facsimiles of two of the labels in use in the Yorkshire Museum, which demonstrate better than words, what we can achieve under this system. The ornaments are fully described, but it is sometimes hardly possible to indicate their exact position, especially in those cases where the ornaments are applied in separate pieces over the surface of body. But we think that enough has already been done to enable students to know more about the specimens than has previously been possible.



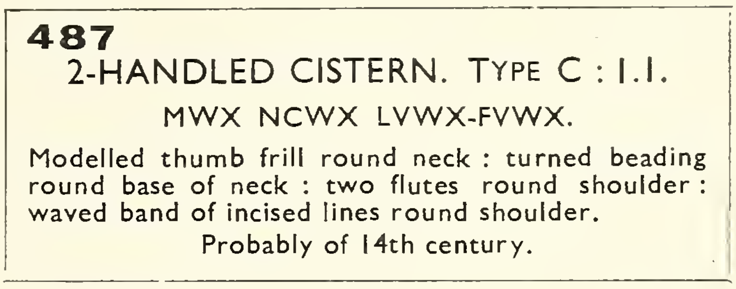
473

JUG. TYPE BLS-C : 1.8 : PE FIDX NC.

Turned large deep flutings on neck, smaller ones on body: step at base of neck. Applied vertical bars bearing impressed pattern.

Found in Blake Street, York, 1876. Bought 1876.

Probably of 15th century.



487

2-HANDLED CISTERN. TYPE C : 1.1.

MWX NCWX LVWX-FVWX.

Modelled thumb frill round neck: turned beading round base of neck: two flutes round shoulder: waved band of incised lines round shoulder.

Probably of 14th century.

It is well worth while to try and draw the jugs to which the above labels refer, from the "type designations" on the labels; there is little difficulty in producing a fairly good representation of the specimen.

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WALTER E. COLLINGE,
Keeper of the Museum.

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